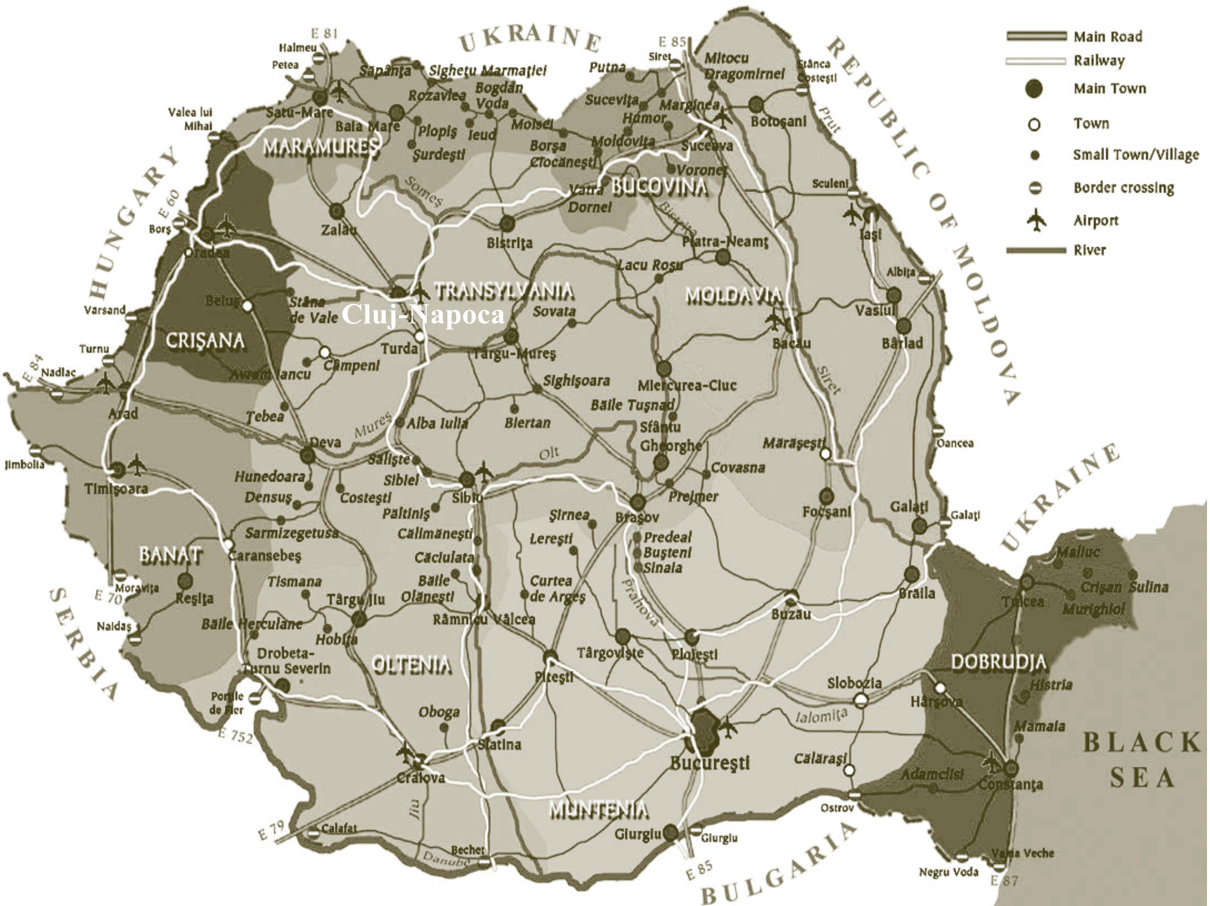
STUDIA UNIVERSITATIS
BABEŞ-BOLYAI



GEOGRAPHIA

1/2017

STUDIA
UNIVERSITATIS BABEŞ-BOLYAI
GEOGRAPHIA

1/2017

EDITORIAL BOARD OF
STUDIA UNIVERSITATIS BABEŞ-BOLYAI GEOGRAPHIA

EDITORIAL OFFICE: Clinicilor no. 5-7, 400006 Cluj-Napoca, Romania,
Phone +40 264 591807, geogr@geografie.ubbcluj.ro;
http://studiageographia.geografie.ubbcluj.ro/

YEAR **Volume 62 (LXII) 2017**
MONTH **APRIL**
ISSUE **1**

PUBLISHED ONLINE: 2017-04-17
PUBLISHED PRINT: 2017-04-31
ISSUE DOI:10.24193/subbgeogr.2017.1

S T U D I A
UNIVERSITATIS BABEŞ-BOLYAI
GEOGRAPHIA

1

STUDIA UBB EDITORIAL OFFICE: B.P. Hasdeu no. 51, 400371 Cluj-Napoca, Romania, Phone + 40 264 405352

CUPRINS – CONTENT – SOMMAIRE – INHALT

STUDIA UBB GEOGRAPHIA, LXII, 1, 2017 (p. 5-27)
(RECOMMENDED CITATION)
DOI:10.24193/subbgeogr.2017.1.01

TECTONIC AND STRUCTURAL RELATIONSHIPS IN SILVANIA MOUNTAINS

I. A. IRIMUŞ[1], CORINA BOGDAN[1]

ABSTRACT. – Tectonic and Structural Relationships in Silvania Mountains. The structural landforms were defined by the fault systems present in the area, as dislocations following the Alpine orogenic system, which imposed the subaerial and submerged dynamics of the landforms, coordinating in this way the modeling systems with the geological time scale, on the basis of complex tectonic and structural, morphotectonic and morphoselection relationships between the geologic structure, the tectonic factors and the external geodynamic agents. The Meseș hemi-anticline is different from the horst of Plopiş as well as Șimleu and Coșeiu Hillocks due to the dynamics, intensity and magnitude of the faulting phenomenon which controlled the sedimentation process and the placement of eruptive bodies. The morphoselection relationships, in which the main role belonged to the selective erosion, facilitated the development of three types of structural (tabular, monoclinal and folded) landforms.

Keywords: *Silvania Mountains, tectonics, collisional chain, geomorphologic structure, relationships.*

1. INTRODUCTION

Silvania Mountains appear as an unusual mountainous segment in comparison with other Carpathian units considering the spatial and morphological aspects as well as the structure and the petrographic composition. They border Silvania Hills to the North, Almaş-Agriji Basin to the East, Vad-Borod Basin, Piatra Craiului Mountains, Vlădeasa Mountains and Gilău Mountains to the South and Plopiş and Oradea Hills to the West.

They are considered by geologists an **Alpine collisional chain**, where, although one can see the marks of a Hercynian orogeny, Variscan remnants incorporated into alpine nappes structures have left *islands of crystalline schists* in the North-Western part of the Transylvanian Basin (*Șimleu Uplifting,* as named

[1] *Babeş-Bolyai University, Doctoral School of Geography, 5-7 Clinicilor Street, Cluj-Napoca, Romania, e-mails: aurel.irimus@ubbcluj.ro; bogdan.corina@ymail.com.*

by geologists or the *Intra-Carpathian Yoke* as called by geographers). Their position, location (fig. 1) and integration into the Alpine-Carpathian system was and remains one of the most controversial issues of the Romanian school of geomorphology and geology.

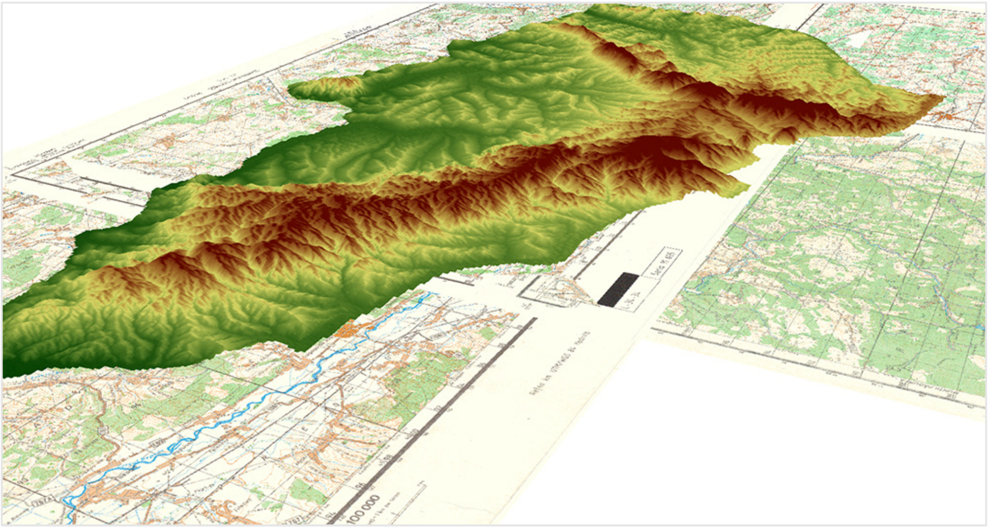


Fig. 1. Silvania Mountains – 3D perspective

Silvania Mountains, considered an **Alpine-type orogenic** unit, submitted to fragmentation and unevenness, were involved into the tectostructural Tertiary movements. The specialized geological and geomorphological literature refers to this unusual unit as follows: Intra-Carpathian Yoke, mountainous Carpathian subunit, complex structural block "Şimleu Uplifting", Silvania Belt, crystalline islands in the North of the Transylvanian Basin, hidden mountains of Northern Transylvania, Preluca-Gilău Island, Preluca Range, Tisia Range, Northern Transylvania Chain, median range, Silvania – Someşan Hills, district of regional Alpine metamorphism. According to geologists, Silvania Mountains would have been part of an immense crystalline Hercynian range during the ***Paleozoic***: ***the Transylvanian-Pannonian Range*** or ***Tisia***.

The Tertiary paleogeographic evolution of Silvania Mountains (fig. 2) emphasized a complex structure, with crystalline seed stripping, brought to the surface due to erosion under the layers of Tertiary sedimentary strata (**Paleogene** on the East side, towards the Transylvanian Basin and **Neogene** towards Silvania Basin and the Western Hills). **A palympsestic morphology unique within the Romanian territory** was outlined in this way (fig. 3).

Fig. 2. Silvania Mountains – panorama from Almaş-Agrij and Șimleu Basins

According to the latest geological research, Silvania Mountains are considered Variscan remnants incorporated into alpine nappes structures. These remnants represent the testimonies of a grandiose **Hercynian chain** that still has unusual fragments (Plopiş Mountains, Meseş Mountains, Şimleu and Chilioara/Coșeiu Hillocks) within the geomorphological landscape of North-Western Romania, as a trace of a vast crystalline area, part of the Preapulian craton and Tisia-Dacia Microplate respectively.

2. DATA AND METHODS

The Hercynian origin of these mountains and the fact that they were not involved in the metamorphism of the Alpine orogeny or the statement that there are no longer Hercynian mountains in Romania and the entire territory would have regenerated during the Alpine orogeny led us to the geomorphological argumentation of a middle position based on the reconstitution of tectonic and structural events related to the modifications of Silvania mountainous space from the point of view of topography and morphology.

3. DISCUSSION AND RESULTS

3.1 The regional tectonic evolution and the geodynamic setting

The geodynamic evolution of the Central Mediterranean, through the opening and the subsequent consumption of the Tethys Ocean crust (Paleotethys and Neotethys) and of some smaller back-arc basins behind their subduction zone, formed the *Alpine orogenic system* to which Silvania Mountains belong too. Its geodynamic evolution is reflected due to the complex Mesozoic–Tertiary interaction between the African-Arabian plate and the European one through the triggering of deformation processes starting with Lower Miocene.

The subunits of the Central Mediterranean: the Pelagian Block (the Strait of Sicily), the Ionic Block and the Apulian Block are important for the Carpathian geodynamics and mainly for Silvania Mountains geodynamics. The geological data confirm the fact that Alcapa and Tisia originated from the Northern margin of the Apulian Block (Săndulescu, 1994; Schmid et al., 2008). The opening of the North Atlantic triggered complex processes of rifting in the area of North Africa which led to the fragmentation of the African margin in minor plates, followed by their successive collision with Southern Europe. This movement is responsible for the *compressive deformations* that had a fundamental role in the formation of the Alpine orogeny. The cause of the compression processes was the detachment of the Carnian Plate from Europe. The closures occurring on its margins led to the compressive deformations in the Alps and the Carpathians. The collision, due to which the alpine nappes in the Western margin of Carnian were formed, is emphasized during Paleocene by the thrust and the generation of nappes in the Alps, in the Carpathians and Silvania Mountains.

On the basis of paleomagnetic, paleobiogeographic and structural data, the Alpine-Carpathian region consists of three continental blocks or microplates: **Alcapa**, **Tisia-Dacia** and **Adria** while the ***intra-Carpathian basement*** is also made of three microplates: **Alcapa**, **Tisia** and **Dacia** (Balla, 1984, Csontos et al., 1992, Schmid et al., 2008). The Alcapa microplate is located in the North of the Pannonian Basin while Tisia and Dacia successively developed in the South of the Pannonian Basin including Apuseni Mountains and the Transylvanian Basin, the two being separated by Alcapa through a major fault with transcrustal character: *Mid-Hungarian Line* (Csontos, Nagymarosy, 1998) active since the Cretaceous and responsible for numerous deformations (Csontos et al., 1992, 2002).

Tisia and Dacia represent two microplates with different geological histories during the Mesozoic era according to paleomagnetic data (Pătrașcu et al., 1994). The movements of these plates are connected to the major convergence between Africa and Europe, a convergence oriented from North to South during the Tertiary (Csontos, 1995). These two microplates collided during Late Cretaceous and thus the **Tisia-Dacia Microplate** was born, a geodynamic reality confirmed by the crustal increase in thickness in the contact area of these two blocks and the tectonic formation of the nappe systems in Apuseni Mountains (Balintoni, 1997, Dallemeyer et al., 1999). The role of these two microplates in the Carpathian geodynamics is relevant and is highlighted by the existence of numerous geological and geophysical studies, undertaken over time by Balla (1987); Ratschbacher et al. (1991); Csontos et al. (1992), Horvath (1993); Royden (1993); Csontos (1995); Nemčok et al. (1998); Fodor et al. (1999); Huismans et al. (2001); Sperner et al. (2002), Seghedi (2005). These authors state that the formation of the Carpathian arc during Tertiary is the result of subduction towards West of a closed basin surrounded to the North and East by the East-European plate and to the South by the Moesian plate. Following the collision of these two continental blocks (Alcapa and Tisia) with the European foreland, the arc structure of the **fold-thrust type belt** of the Carpathians appeared during Late Negeone because of the movement towards East of the Tisia-Dacia block mainly due to the convergence of the Adriatic plate and to the withdrawal of the oceanic plate (Linzer at al., 1998).

The Romanian Carpathians represent a compressive belt with a structure similar to an arc. The deformation age leading to the thrusting of the Carpathian nappes over the foreland coincides with the moment of collision and became increasingly smaller, as the collision extended towards South along the Carpathians. Thus, within the Western segment, the age of collision is Karpatian 17 my (Royden et al., 1982 and Săndulescu, 1988). Royden et al. (1982), Csontos et al. (1992) and Meulenkamp et al. (1996) admit the existence of a progression of deformations along the nappe system from West to East. From Eocene until Early Miocene (32-24 my) important processes of compression took place on NNE-SSW direction, accompanied by extension processes ESE-WNW, which assembled the blocks inside the intra-Carpathian area (Sperner et al., 2002), and in particular those of Silvania Mountains as indicated in the DEM (fig. 3) (Mac, Irimuș, 2000). During the Middle Miocene (24-16.5 my) the regional tectonics were dominated by a translation towards East and concomitant rotations, but also by the opposite directions of Alcapa and Tisia blocks, rotation completed through their collision with the European plate and the triggering of a *strike-slip* regime along the Northern margin of the Alcapa block. Therefore both microplates have suffered counterclockwise rotations and important translations proven by paleomagnetic data (Marton et al., 1992, Pătraşcu et al., 1994, Panaiotu, 1998, etc).

The kinematics of the Carpathians is linked to the evolution of the Eastern Alps. They appeared due to a strong collision while the Carpathians are the result of a low intensity collision through retrograde subduction linked in this way to the orogenic collapse of Eastern Alps (Royden, 1993). Other possible causes of the tectonic forces responsible for these compressions are the slab-pull processes which led to roll-back processes of the plate along the subduction zone of the Carpathians (Royden, 1993). The asthenospheric flow directed towards East determined the rotation of the subduction zone, together with a translation movement of the lithospheric plates (Doglioni et al., 1999). The movement of these plates towards East has been influenced by the existence of the oceanic subduction in the External Carpathians during the Early Miocene through the consumption of the basin with oceanic crust in front of the European Plate, approximately 500 km wide (Csontos, 1995), under the Tisia-Dacia microplates.

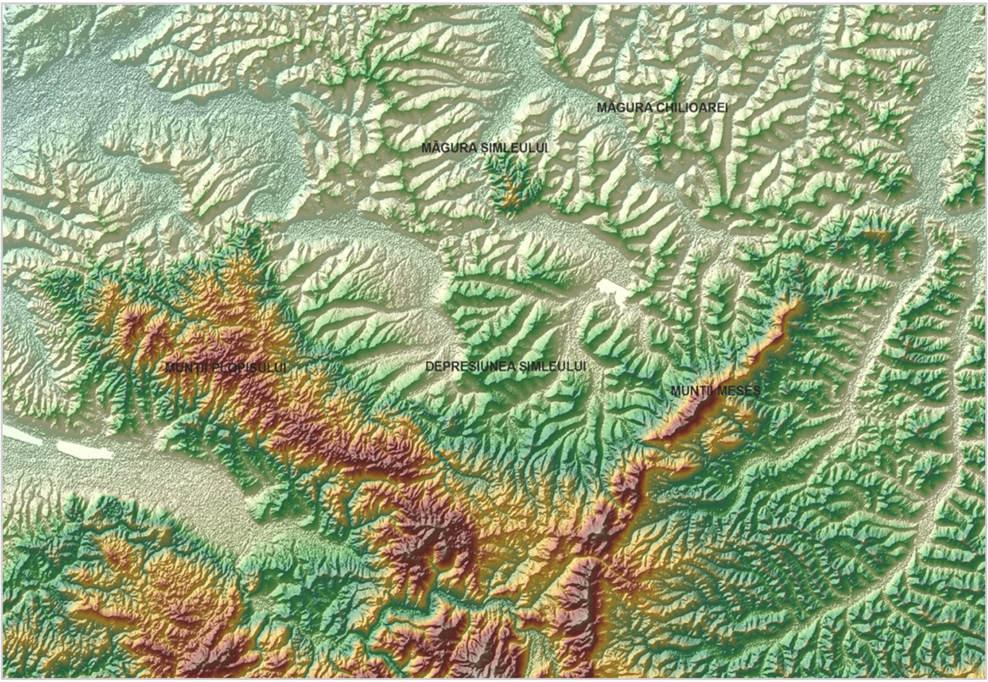


Fig. 3. Silvania Mountains (Plopiș, Meseș, Șimleu Hillock, Chilioara Hillock) in a DEM perspective

The withdrawal of the subduction zone led to an increase in the movement of the microplates towards East and North-East (Royden, Burchfiel, 1989, Royden, 1993). Therefore, during the Late Miocene, the compression forces in the Carpathian-Pannonian area determined the contraction processes, respectively *crustal shortening* (~ 300 Km) within the Carpathian plates (Tari et al., 1992).

In contrast with the crustal shortening of the Carpathian arc, the South of the Pannonian Basin indicates an extensional regional movement ~ 230 km during the Neogene (Tari et al.,1995) of back-arc type. Royden (1988) explains the back-arc extensions within the Panonnian Basin on the account of the withdrawal of the subduction (soft subduction) characteristic to situations where the subduction rate is higher than the convergence rate of the plates. Based on the above, the deformation during Middle Miocene-Pliocene was induced by the retrograde subduction of the oceanic plate between the European and Moesian plate and because of the movement towards East of the Tisia-Dacia block, which will result in the closure of the oceanic basin and the collision of the Tisia-Dacia block with the foreland of the European and Moesian plates which led to the arc structure of the Carpathians while the retrograde subduction from East to West produced the calc-alkaline volcanism. Konecny et al. (2002) proposed a model of the geodynamic evolution of the Carpathian arc and of the Pannonian Basin during the Neogene.

The structural evolution (fig. 4) is like an interconnected system consisting of four main elements: Alpine obduction and the development of compressive orogenic centers due to the movement of the Adriatic plate, a lateral extrusion of the Alcapa lithosphere due to alpine collision; a gravitational subduction of an oceanic lithosphere in the area of the Carpathian arc and a back-arc extension due to the diapiric elevation of the asthenospheric mantle. The low depth of the lithosphere-asthenosphere limit under the Pannonian Basin indicates an asthenopheric elevation during Tertiary.

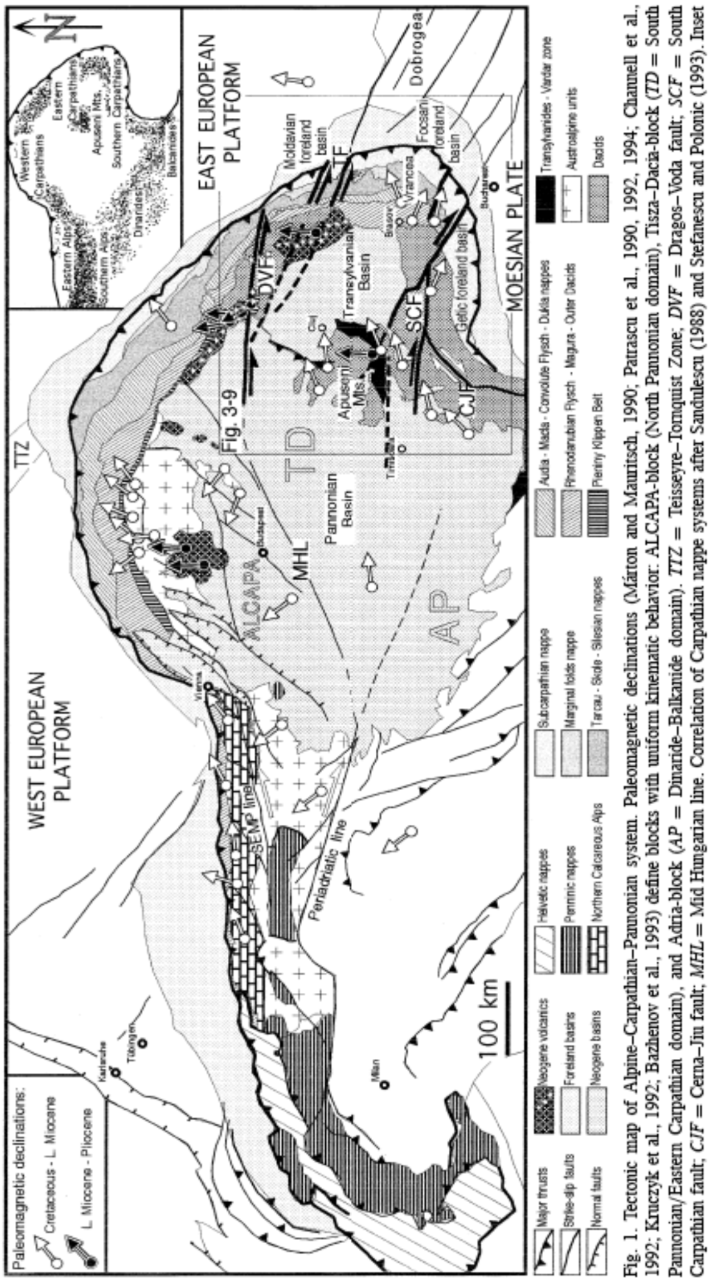


Fig. 4. The tectonic map of the Alpine-Carpathian-Pannonian system
(source: Linzer et al., 1998)

3.2 Tisia-Dacia Microplate and the tectonic and structural implications for Silvania Mountains geodynamics

Silvania Mountains, as an **Alpine collisional chain,** are the result of a complex geodynamics, on one hand a Hercynian one and on the other hand mostly Alpine, being part of the continental margin of the Apulian or Adrian microplate. In Romania, it has different names within the geological literature: **Preapulian Craton, Austro-Bihorean Block, Tisia-Dacia Microplate, Intra-Carpathian Microplate** (Zugrăvescu and Polonic, 1997) and more recently it received the name of **Interalpine Microplate** (Beșuțiu, 2001). We use the name of Tisia-Dacia. The spatial delimitation of these two cratons (Tisia and Dacia) is needed for a better understanding of the structural constitution of the nappe system in the Apuseni Mountains and their structural relevance for the geodynamics of Silvania Mountains. The Preapulian Craton *bordered* Tethys to the North (divided into the Transylvanian, Penninic, Liguro-Piedmontese areas) and the Pannonian sphenochasm to the South (which includes the Apusenides, Mecsek-Villany area, Zemplin block, Western Carpathians and Austro-Alpine domain). The Getic Craton, according to Săndulescu (1984), Froitzheim et al. (1995), Marchant & Stampfli (1995) would represent a link between the external Dacian rift and the Valais rift, therefore, according to this perspective, it includes the area bounded on the West by the North Transylvanian Fault, the Szolnok block, the basement of Măgura flysch and the Brianconnais domain. We mention the rotation of the Tisia around a pole situated in South-Eastern Serbia, rotation completed by its Tertiary movement still heading NE (Pătrașcu et al.,1994) which determined the shearing of the Southern margin of Penninic Tethys and the formation of nappes from the Biharia system (derived from the Southern part of the active margin of Transylvanian Tethys) while the Codru nappes were detached from the passive margin of the Meliata-Hallstatt ocean, placement completed during the Late Cretaceous (Kovac et al., 1994).

During the Late Cretaceous, the Preapulian Craton was located between the Penninic Tethys to the North and Meliata-Hallstatt Ocean to the South. The **Apuseni Mountains,** mainly **Silvania Mountains**, were **part of the Tisia-Dacia Microplate** within the Austroalpine-Carpathian system and included the Bihor Autochthonous unit, the Codru nappe system –cover nappes, Biharia nappe system – basement nappe and the Transylvanide Nappes – obduction nappes (Săndulescu, 1984) that originated from the major Tethysian lithosphere. The pre-collisional tectonic setting of the latter was that of an island arch accompanied by a marginal basin according to Nicolae (1995) which moved under the Pre-Apulian Plate. The nappes system from the Apuseni Mountains appeared during three tectogeneses: Cretaceous tectogenesis, Pre-Gosau tectogenesis and Laramian tectogenesis. In this context, the Alpine geosynclinal of Silvania Mountains was installed on the peneplenized area of the Hercynian structures that formed the Tisia microplate.

The ancient cratons Tisia and Dacia (the current Tisia-Dacia microplate) were part of an intense collision during the Alpine orogeny. According to Royden (1993), during the **Cretaceous tectogenesis**, the tectonic regime at the convergent contact between the Pre-Apulian plate and Getic plate was of *advanced subductional type* (Balintoni, 1994). The Pre-Apulian craton was submitted to compression and shortening, therefore the crystalline basement was strongly deformed, setting the **Apusenide** as cover and basement antithetic nappes, reality confirmed by the mylonites in Meseş Mountains. As a result of disjunctive movements due to the Alpine orogeney, certain parts of the ancient Tisia craton were isolated as peaks and hummocks like those in Silvania Mountains which highlight Șimleu Basin (Plopiș, Meseș, Șimleu and Chilioara/ Coșeiu Hillocks) being incorporated as Variscan remnants in these structures of alpine nappes. Stan and Puște (2001) take into account data from Balintoni (1997) and Pană, Balintoni (2000) in the context of the Paleozoic development of the Alps proposed by von Raumer (1998). They consider that the Apuseni Mountains and the Biharia nappes were formed within the extensional regime of the Alps during Paleozoic, due to subduction, being also formed the Biharia protolith, model supported by radioactive dating U/Pb on granitoids that indicate an age of about 500 My (Pană, 1998). According to them, in Ordovician the Gondwana blocks started moving towards North colliding with Laurussia or with blocks annexed to Laurussia, the end of collision occurring during the Middle Devonian. The Devonian oblique convergence formed in the Alps the nappes of the *pre-Variscan suture* and now, in the Apuseni Mountains, the *Biharia arc* was caught between the granite–gneiss Northern terrains (Someș) and gneiss-carbonate Southern terrains (Baia de Arieș).

In the collision area between the Biharia arc and the Someș Northern terrain, the crustal thickness led to melting which generated the 400 my Codru migmatites according to Dallmayer et al. (1999). The Someş lithogroup has a tectonic accretionary prism setting (where one can also find oceanic crust lame) with strong input from the arc (Biharia volcanic arc; Biharia remnants of an island arc, which marked a suture between the Someş lithogroup and Baia de Arieș lithogroup approximately 400 my ago). The K-Ar ages for metamorphites in Romania (Soroiu et al., 1982, Mânzatu et al., 1975, Pavelescu et al., 1976, Ignat et al., 1982, Ichim et al., 1984, Soroiu et al., 1985, Strutinski & Soroiu, 1985) indicate that in the Upper Paleozoic, the Preapulin and Getic cratons were located in Southern Europe, heavily affected by the Variscan events. As a result, they were involved in a subsidence partially caused by Variscan molasse according to Argyriadis (1975).

After this, a series of basinal sequences appeared at the beginning of the collisional period during the Lower Late Cretaceous. The downward (digging-in) and then upward movement – exhumation is confirmed by the *collapse of the Variscan orogeny of Tisia and the disinterment of metamorphites at average crustal depths*. The main type in these cases is the **blasto-kinematic metamorphism**, which resulted in the development of **schistuous metamorphites** from **Șimleu Uplifting** and **Silvania Belt**, crystalline remnants of **Tisia, the ancient crystalline craton**.

In this geodynamic context, the Șimleu Basin, from a geological and structural point of view, represents one of the five basins formed by the collapse of the crystalline basement of the Tisia Craton. During the Alpine orogeny, the area was affected by vertical, predominantly disjunctive, movements, which fragmented the ancient craton in a series of *smaller blocks*. The predominance of the disjunctive tectonic style since the Mesozoic intensified in the Late Cretaceous and it is noticed during Tertiary, due to the sinking of large blocks maintaining in their physiognomy the descending direction of movement, therefore the crystalline was affected by the deep rifts that have caused the unevenness of blocks in Silvania Mountains. In Romania, one can no longer discuss about Hercynian chains, but Variscan remnants incorporated into alpine nappe structures.

3.3 The structural landforms of Silvania Mountains

The structural landforms of Silvania Mountains are conditioned by *the systems of faults* present in the area which determined the tectonic fragmentation and led to a *horst- graben* system. The formation of these structures is the result of Neogene extensional development of neighboring Transylvanian and Pannonian Basins (Fodor et al., 1999) as well as of translational post-Eocene movements (towards North) and a large clockwise rotation of the Tisia block with an angle between 90º and 120º around the Moesian Plate on the basis of a compressive tectonic (NNE-SSW) and extensional regime (E-W), fact confirmed by the movement of cortical faults of strike-slip type which contributed to the structural geodynamics of Silvania Mountains (Pătrașcu et al., 1994; Csontos, 1995; Panaiotu, 1998; Seghedi et al., 1998; Roșu et al., 2000). The current aspect of Silvania Mountains is due to three major tectonic events: the first event refers to the Paleogene – Neogene deformation fields, which affected the rotation of the Carpathian nappe system (in particular, those of the Apuseni) around the Moesian Plate; a reorientation of the deformation field during the Middle Miocene, which was caused by the retrograde subduction towards East, therefore a new fault system pushed the Carpathian nappes in the E-SE direction; the last and the most recent event consisted of a reorientation of the deformation field during the Pliocene-Middle Miocene, characterized by fanwise directions of compression, as those from Silvania Mountains, as it is noticed in the DEM model. Silvania Mountains branch out of North Apuseni as an *independent chain* from the point of view of direction and structure, with an island and V-shaped configuration.

The post-tectonic movements have fragmented this chain compressing it towards the Getic craton located in the basement of the Transylvanian Basin. Approaching an argument of the magnitude of the tectonic and structural relationships within Silvania Mountains implies referring to the Paleogene and Neogene sediments, to the bedded character of the deposits, to the position ratios between the rock masses, deformations, fractures and schistosity plans as structural factors.

Silvania Mountains present structural landforms (fig. 5) conditioned by the fault systems, which have determined a *dynamics of the subaerial and submerged landforms*, coordinating in this way the modeling systems with the geological time scale. The Sub-Hercynian (Mediterranean) diastrophism, but especially the Laramian one, are responsible for the fragmentation and dismantling of *Gilău-Plopiş-Meseş-Preluca Island* into **horsts and grabens**, reactivating old fault lines or generating new ones. The geologic basement of Plopiș Mountains and Meseș Mountains is implicitly represented by the Bihor Autochthonous, characterized by two crystalline series, Someş and Arada, and a sedimentary suite (Permian, Triassic, Cretaceous), divided into horsts and grabens, as a result of diastrophism during the Cretaceous until the Pliocene and which affected both the crystalline basement and the sedimentary cover.

Fig. 5. The geomorphological maps of Silvania Mountains


I.ELEMENTE GEOLOGICE SI STRUCTURALE.
ELEMENTI GEOLOGICI E STRUTTURALI.
(I). 1.LITOLOGIA SUBSTRATULUI.
LITOLOGIA DEL SUBSTRATO.
Roci metamorfice sistoase.Rocce metamorfiche scistose.
Seria de Meses (Paleozoic Inferior- Precambrian).
Seria de Somes (Precambrian Superior).
Roci vulcanice efuzive.Rocce vulcaniche effusive.
Magmatite neogene-dacite si andezite.
Magmatite Senonian-Paleocene (dacite).
Roci silicioase.Rocce Silicee.
Camplian Inferior-Werfenian (gresii silicioase).
Roci predominant calcaroase.Rocce prevalentemente calcaree.
Priabonian.
Roci predominant dolomitice. Rocce prevalentemente dolomitiche.
Priabonian.
Roci predominant argiloase .Rocce prevalentemente argillitiche.
Oligocen-Miocen Inferior, Stratele de Moigrad (Chattian-Rupelian).
Roci marnoase.Rocce marnose.
Pannonian (Malvensian),Lutetian.Badenian.Sarmatian.Miocen.
Pietrisuri si conglomerate.Ghiaie sciolte e conglomerati.
Pleistocen Inferior.
Contact litologic.Contatto litlogico.
III. FORME, PROCESE SI DEPOZITE DE VERSANT
DATORATE GRAVITATIEI.
FORME, PROCESSI E DEPOSITI DI VERSANTE
DOVUTI ALLA GRAVITA.
(III). 1.FORME DE EROZIUNE.
FORME DI EROSIONE.
Alunecari de teren.Frane.
Fenomene de creep. Fenomeni di creep.
Suprafete cu forme de curgere concentrata
(ravene si torenti).Superficie con forme di dilavamento
concentrato (ravene e torenti).
(III).2.FORME DE ACUMULARE.
FORME DI DEPOSITO.
Con detritic activ. Cono detrittico attivo.
Con detritic inactiv. Cono detrittico inattivo.
Depozite eluviale.Depositi eluviali.
(IV).2. FORME DE ACUMULARE.
FORME DI DEPOSITO.
Depozite aluvionale recente.Depositi alluvionali recenti.
Holocen.
Depozite aluvionale terasate, terase.Depositi alluvionali terrazzati.
Pleistocen.
Depozite coluviale. Depositi colluviali.
Cuaternar.
Curgeri noroioase. Depositi di debris flow.
Con aluvial si torential activ. Conoide alluvio torrentizio attivo.
Con aluvial si torential inactiv. Conoide alluvio-torrentizioinattivo.
VII. FORME RELICTE, SUPRAFETE DE NIVELARE
SI FORME ASOCIATE CU O GENEZA COMPLEXA.
FORME RELITTE, SUPERFICI DI SPIANAMENTO
E FORME ASSOCIATE TALORA
DI GENESI COMPLESSA.
Suprafata de nivelare I Pria - Merisor(800-1000m).
La superficie di spianamento Pria- Merisor (800- 1000m).
Suprafata de nivelare II Talhareasa -Secatura (650-750m).
La superficie di spianamento II,Secatura- Talhareasa(650- 750m).
Martori de eroziune.Testimoni di erosione
(I). 2.ELEMENTE TECTONICE.ELEMENTI TETTONICI.
Falie. Faglia
II.FORME STRUCTURALE SI VULCANICE.
FORME STRUTTURALI E VULCANICHE.
(II). 1. FORME STRUCTURALE. FORME STRUTTURALI.
Fronturi de cuesta. Orlo di cuesta.
Front de suprafata structurala. Orlo di scarpata strutturale.
Inseuare.Sella.
(II). 2.FORME VULCANICE. FORME VULCANICHE.
Neck vulcanic.Neck vulcanico.
Con polifazic. Cono poligenico.
Dyke. Dicco.
IV.FORME SI DEPOZITE FLUVIALE DE VERSANT
DATORATE SCURGERII.
FORME E DEPOSITI FLUVIALI DI VERSANTE
DOVUTI AL DILAVAMENTO.
(IV).1. FORME DE EROZIUNE.
FORME DI EROSIONE.
Curs de apa permanent.
Traccia di corso di acqua estinto.
Vai fluviale de tip V. Vallecola a V.
Vai cu fund concav.
Vallecola a fondo concavo.
Front de terasa aluvionala.
Orlo di terazzo alluvionale.
Suprafete cu forme de curgere difuze.
Superficie con forme di dilavamento diffuso.
V.FORME SI DEPOZITE DE ORIGINE CARSTICA
(V).1. FORME DE EROZIUNE.
FORME DI EROSIONE.
Dolina cartografiabila. Dolina.
VI.FORME SI DEPOZITE DE ORIGINE PERIGLACIARA.
FORME E DEPOSITI DI ORIGINE PERIGLACIALE.
Panza de grohotis.Falda di detrito.
VIII.FORME, DEPOZITE SI ACTIVITATI ANTROPICE.
FORME , DEPOSITI E ATTIVITA ANTROPICHE.
Mina, galerii de excavare antropica.
Cava, imbocco di galleria di scavo antropico.
Suprafete de excavare antropica.
Superficie di sbancamento.

The border and basement formations are made of crystalline schists, meso-metamorphic schists (Someş crystalline) and epimetamorphic (Green schist facies), with a discrepancy in metamorphic grade over the Someş crystalline. These are followed by pre-Neogene sedimentary deposits (the Lower Triassic, the Upper Cretaceous and the Danian-Paleocene) and Neogene sedimentary deposits (filler sediments of the Şimleu Basin, respectively Badenian, Sarmatian, Panonnian, Pontian and Quaternary) laid down during three sedimentation cycles. The position and the structural ratio of Silvania Mountains with the neighboring units, as well as the presence of remnants from the ancient mountainous chain, indicate a well-individualized geographical region, on crystalline basement, strongly fragmented and marked by levels towards West. As previously mentioned, the formation of the horst and grabens systems of Silvania Mountains is due to the strike-slipe tectonics.

The tectonic structure, Carei-Preluca fault, continues in Hungary through the sinestral shear zone, Mid Hungarian Line, which is connected towards East to the fault system in the North of the Transylvanian Basin (Dragoş Vodă, Bogdan Vodă and North Transylvanian faults), where the paleostress measurements indicate sinestral lateral movements with associated tectonic structures. The Tisia-Dacia block moves towards East along the Mid Hungarian Line shear zone (Carei – Preluca – North Transylvanian System). The tectonic and structural relationships within Silvania Mountains are defined by two types of relationships: morphotectonic ones and morphoselective ones, with reference to the fault systems present in the region.

3.4 Morphotectonic relationships in Silvania Mountains

The geological structure played a significant role in the morphology of Silvania Mountains through the complex systems of faults in the area which imposed the modeling and the evolution of the structural landforms. The evolution of Silvania Mountains morphology was conditioned by the strong rectangular fragmentation of the Tisia block (according to Păucă, 1964) and its following vertical movements through the formation of the horsts-grabens system as a result of diastrophic processes. Silvania Mountains comprise *Plopiş Mountains, Meseș Mountains, Şimleu Hillock* and *Coșeiu Hillock,* and there are complex tectonic and structural relationships between these subunits.

The asymmetric crystalline horst of Plopiş Mountains, the Western side of Silvania Mountains, spreads over 37 km and has an island configuration, respectively a general NW-SE orientation of the tops (in line with the Carpathian direction), being surrounded by a fault with Pannonian direction (NE-SW) and of secondary faults on the N-S and W-E direction. The age of the main and secondary faults within Plopiş is Laramian, because of the banatites laid down on them (Patrulius, 1972, Bleahu 1976, Păucă, 1964). These fault systems gave the dynamics of the relief. The Mesozoic sedimentation processes within Plopiş Mountains did not take place in its current area, thus there are two hypotheses: during the Upper Triassic and the Jurassic, the Plopiş functioned as a horst, only in subaerial regime, although towards the South, in Pădurea Craiului Mountains, the Jurassic series is complete (in the geological literature, it is mentioned a mainland located in the North of Bihor Platform); during the Upper Triassic and Jurassic, the alternation of *ascending and descending movements on fault lines* from the Northern platform of the Tethys is the result of the *Eokimmeric* and *Neokimmeric phases*, followed by the Austrian phase, which determined the removal of sediments of the same age through erosion. To these we also add the lack of nappe structures in the Plopiș Mountains. The subcrustal dynamics of the *Plopiş subcrustal block* confirms the fact that they would have detached from *Muntele Mare crustal block* (Socolescu, Airinei, Ciocârdel, Popescu, 1975), in the shape of crustal scales or transition masses linked to the Bihor-Olt fracture and the Mureş geosynclinal. The research in Geophysics confirms the *disordered tectonic block structures* which crop out from the Neogene and the small crystalline formations in Silvania Mountains. The presence on the isostatic map of an important point, spreading towards West, from Telciu-Răzoare-Jibou until the Meseș Mountains, due to the rotation of blocks and crustal scales towards West, around an area in the North of Borșa, surrounding and compressing, with the blocks from the Apuseni Mountains, the area under the Transylvanian Basin, is a proven fact. Within Plopiş, there are transversal fault systems which have equidistant fractures, being crossed by vertical and subvertical faults, the most important being the *Aleuș-Pandorac fault* (NE-SW) and *Plopiş-Vuica fault* (NE-SW).

The dominant note of the structural morphology in the Plopiş Mountains is given by Măgura Synclinorium. *Meseș Mountains*, as part of the Eastern Silvania Mountains, represent a *hemi-anticline* with the eastern flank oriented SW-NE, having a length of around 35 km and a width of 2-5 km. The *tectonic phenomena* in Meseș Mountains (Szadeczky-Kardoss, 1925-1926) are represented by folding (in what concerns the metamorphism) due to *ante-Permian folding* and *mesozonal* and *kata metamorphism* (indicated by the diaftorites of the first crystalline series and the imprisonment of ancient crystalline schists of Verucano conglomerate, less metamorphosed). In agreement with the authors, the Mesozoic strata were folded and metamorphosed especially in the epizone, reality confirmed the Permian conglomerate and the Guttenstein limestone – epizone crystalline schists folded between other crystalline schists of Meseş Mountains. In what concerns the Upper Cretaceous sediments, they are not metamorphosed, therefore the discrepancy between the Upper Cretaceous basement and the Eocene strata confirms the existence of a folding period at the end of Cretaceous, with a maximum folding of intra and post Mediterranean age, with a SW-NE direction, causing a *strong folding of the Meseş*. The arguments for this hypothesis are the Eocene and Oligocene basements folded together and the conformity between Oligocene and Lower Mediterranean. The main direction of Alpine folding of the Cretaceous and Tertiary in the Meseş is NE-SW and the *faults and dislocations* specific to this area represent dislocations following the Alpine orogenic system, being parallel to the main NE-SW direction. As opposed to the Plopiş Mountains, there are fragments of nappe structures belonging to *Gârda Nappe* according to Horvath (1982) and Balintoni (1985).

The *Meseș hemi-anticline* is different from the horst of Plopiş due to the *dynamics, intensity* and *magnitude of the faulting phenomenon*, as three major faults are noticed: Moigrad fault, Meseș fault and Benesat-Cuceu-Moigrad fault. *The Moigrad fault* is a deep faulting zone, characterized by a pronounced instability, which determined a powerful subsidence and the control of sedimentation, as well as the placement of magmatic rocks in the area. It also has a thrust character, being known as the *Meseș overthrust line*. The Paleogene strata are overthrown and overlapped by crystalline. The fault was active especially during the Miocene. It is accompanied by numerous perpendicular or parallel secondary faults that affect the sedimentary deposits and the crystalline structures, in the shape of a *transverse fracture system.*

The Meseş Mountains highlight the tectonic and structural relationships between the basement (in this case the fault systems) and the external modeling agents. The linear erosion of the transversal water streams (Poicu, Poniţa, Ragu Valley) determined a modeling of the fault fronts in the shape of trapezoidal and triangular facets, in particular in Meseş, near Grebeni Peak, Măgura Priei Peak, Tabla sub Pietre Peak, Citera Poniţa Peak, Găsin Hill, Ragu Peak and Gruiu Peak, unlike in Plopiș, Șimleu Hillock and Coșeiu Hillock (fig. 6). The fault fronts in the Meseş and Plopiș were submitted to dismantlement through areal and linear erosion and sedimentation, therefore lower landforms appeared in comparison with the initial placement where the faulting phenomenon took place, as shown in this transversal profile on SW-NE direction over the southern Meseş, in Ciucea-Buciumi sector (fig. 6). In Meseş Mountains, as a result of faulting processes, the slopes sectioned by faults have detritus nappes at Stâna, Fetindia, Carpeni, Meseşenii de Sus, Tabla sub Pietre, Hodin Tableland, unlike in Plopiș.

Another structural feature of Meseş as opposed to Plopiş is the presence of fault valleys (Poicu and Ragu Valley) due to tectonic disorders which determined a process of mechanical fragmentation of the rock, in line with the fault planes. These cataclastic strips can be areas of major erodability, where a flowing channel can be installed in the shape of a fluvial valley resulting in this way "transversal valleys on faults" such as Poniţa Valley and Ragu Valley, which drain their waters along fault lines.

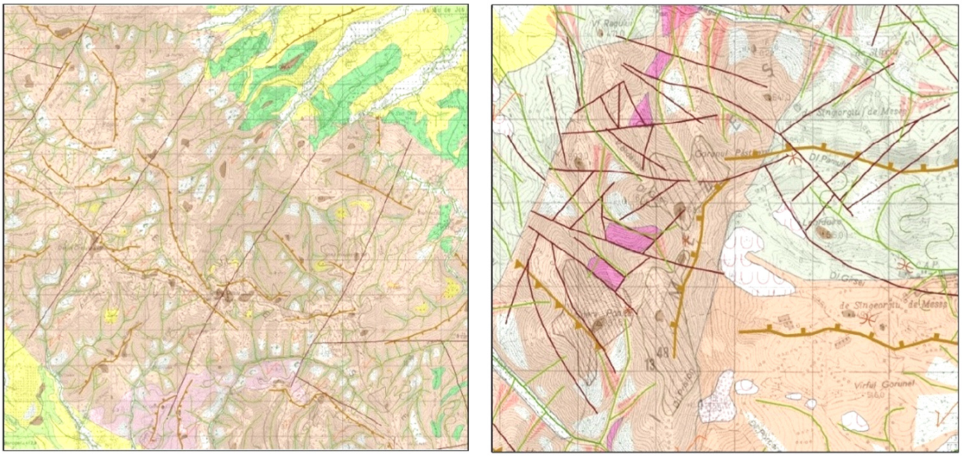


Fig. 6. Fault systems in the Meseş and Plopiş Mountains

At the contact of **Benesat-Cuceu-Moigrad** fault with Moigrad faulting zone, a series of eruptive bodies of microgabbro and andesites (Moigrad Hillock) have been placed, unlike in Plopiş, where there are no explicit marks of magmatic activity due to the presence of faults. Instead, in Plopiș, the NE-SW local fault systems, which flank on both sides the Plopiș summit and their tectonic basement, were formed on the old shoreline, especially on the Northern side. Therefore, coastal platforms composed of submontane deposits were left in the overall morphology as erosion marks, discordantly sitting over the crystalline. Regarding the morphotectonic attributes of the two hillocks, Șimleu and Coșeiu, we have found the following. *Șimleu Hillock* presents itself in the shape of a crystalline island (the crystalline schists from its composition belong to the Someș Series), composed of two terrigene complexes (the lower one made of quartzites, schists and muscovite and biotite paragnaises of Șimleu and the upper one of quartzites, schists and mica-schists of Cehei) separated by an acid magmatogenic complex.

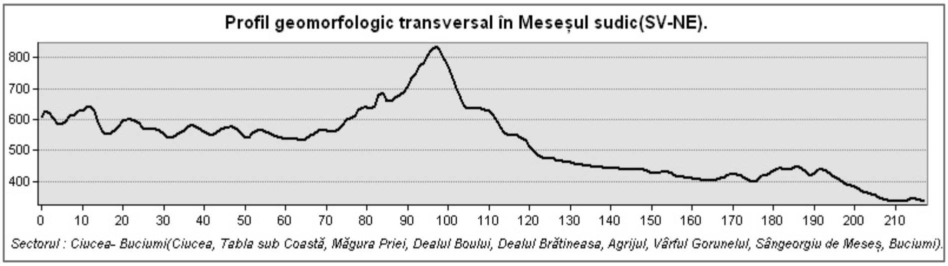


Fig. 7. Transversal geomorphological section across Meseș Mountains

The metamorphic processes have been defined by three Blastese phases (according to Kalmar, 1996): a progressive phase of high temperature and low pressure, a regressive phase – in the green schists facies, as in Plopiș and Meseș, and a new progressive phase – which has three schistosity surfaces as well as two fissure systems. The age of the metamorphism is Hercynian or older, and the K-Ar age values of around 100 my are due to the thermic front of the Middle Cretaceous, during the collision between the Tisia and Dacia domains.

On the basis of some local references (gneiss, biotite quartzite and graphite quartzite), the structure of the range was deciphered, being made of a succession of E-W faulted folds, some of them with the tectonic shank thinned away, with narrow milonitic areas. Over the surface of the crystalline, one can recognize the remnants of an ancient alteration crust, on which small areas of Paleogene (Jibou Formation), Badenian and Panonnian deposits can be found. Considering the faults bordering this crystalline island, the Șimleu-Bădăcin fault (with a SW-NE orientation) in the South-Eastern part of the range is relevant. The crystalline schists near it have a fall close to 90° and come into contact with Badenian and Pontian sediments. The crystalline schists in Măgura Șimleului are covered by Danian-Paleocene deposits. In what concerns Coșeiu Hillock, with an ENE direction from the Şimleu crystalline, it spreads near Coşeiu village, in the shape of a small crystalline island, with an area of around 2 km and a WNW-ESE orientation, falling towards ENE. Coșeiu Hillock represents a bigger crystalline block, under Tertiary sediments (Badenian and Sarmatian), being partially brought to surface by erosion processes. A complex system of faults, with SW-NE and E-W orientation, separates towards East the Hăghișa crystalline from the Șimleu Basin; these faults can also be seen near Chilioara and Guruslău villages. To the North of Chilioara, along the fault, volcanic events with explosive character took place. Their marks are the Dacitic agglomerate in Lighet Hill and, in this respect, Chilioara is similar to Meseş. Păucă (1964) asserts that this eruption center provided the cineretic material between the Badenian and Sarmatian sediments. To the North of Archid, near Coșeiu Valley, the crystalline can be seen emphasizing a lift of the basement in the direction of Codru Range.

3.5. Morphoselective relationships

The role of the geological factor in the erosion modeling can also be that of passive control of landforms, because structural and lithological discontinuities present in the rocks exposed to erosion facilitate the selectivity of the erosion processes (fig.7). In this respect, we can speak of morphoselection and tectonic and structural relationships between the tectonic process intensity and the competence of rocks in Silvania Mountains, which favored the development of three types of structural landforms: on folded structures, on consistent horizontal structures and on monoclinal structures.

The relief of consistent horizontal structures is characteristic to Şimleu Basin. The composition of the basement in mesozone rocks and the rarity of Paleo-Mesozoic sediments confirm the fact that during the pre-Badenian the region was submitted to ascending processes and intense erosion. The crystalline islands of Silvania Mountains have an advanced evolution, and the tectonic and structural relationships of the crystalline with the discordant sediments is reflected from a structural point of view by ancient erosion surfaces, whose presence can be noticed at different altitudes.

The Danian – Paleocene erosion surface, *Pria-Merișor* (Savu, 1965), located at 800-1000 m (it is located at lower altitudes in Șimleu Hillock, while it is buried in Coșeiu Hillock) and *Secătura –Tâlhăreasa* (Pop, 1964), more recent and strongly fragmented (650 - 750 m), are both important and are intersected by faults. The alternance between the hard rocks from the basement and the soft ones from the sedimentary cover, on fault lines, facilitated the modeling of some structural surfaces, asymmetric valleys, border cuestas, exhumed peneplains (Paleogene in Plopiș) and contact basins. The exhumed peneplains, with some exceptions, maintain their initial physiognomy here and there and, subject to erosion, they are modeled as border glacis, abrasion-accumulation surfaces, submontane accumulation glacis.

The contact basins stretch between the border cuesta and the old range border. Contact erosive basins (Pria, Ponița, Hurezu Mic and Meseșeni in Meseș, Tusa, Preoteasa, Plopiș, Halmășd and Cerișa in Plopiș) developed as a result of the structural contact between the crystalline and the sedimentary rocks, on the fault lines of Şimleu Basin and the Meseş hemianticline. *The landscape of the monoclines* of Silvania Mountains formed on complex tectonic and structural relationships between the geological structure (the unconformities between the strata with different dips and resistance to shaping) and the external agents (the drainage network). Against the negative movements of the sinking blocks of Silvania Mountains, the westerly rivers get in regressively. These rivers disarranged the old artery, through consecutive disturbances. Thus, the current network (Barcău, Crasna, Crișul Repede and Zalău), which affects the monoclinal structure both in depth and sideways, formed during the Middle Quaternary. By the way the valleys affect the monoclinal structure, one finds consequent, subsequent and obsequent streams in Silvania Mountains.

The landscape of folded structures represents a different type of tectonic deformation formed against complex tectonic and structural relationships between the structure and the tectonic processes (ascending, descending movements, basculations, inflections) *as folds* (depth and surface folds), as a result of the upright movements of the Tisia block. Silvania Mountains appeared in a sedimentation basin (*the Transylvanian lagoon*), independently located, in the North-West of Transylvania, subject to the repeated transsgresions of the Paratethys. Thus, the sedimentary deposits of Meseş Mountains display strongly reshaped terrigenous sediments that underwent an advanced alteration and a long transportation process. These sediments display a high degree of erosion (red shales). The Meseş Mountains Eocene was formed following the erosion of rocks from the neighboring crystalline mountains. Thus, the Eocene deposits were folded as anticlines and synclines. The NW-SE orientation of Silvania Mountains is the main tectonic orientation of NW Transylvania, being emphasized by the two rows of crystalline mountains that separate the Transylvanian Basin from the Pannonian Basin (the first - Plopiș Mountains, Meseș Mountains, the second one - Șimleu Hillock and Bâcu Mountains). The Pontian sediments of the central areas of Şimleu Basin cover the Miocene sediments, and in the border areas they stretch unconformably over the crystalline. As a result of the rigid crystalline basement proximity to the top, these deposits of the higher structural sub-stage display simple tectonics. Mostly, they find themselves in their initial position, with a monoclinal succession with a fall less than 12º and small ridges under the form of *large upwarping folds* due to *transverse fault lines* in the basement of the area. They display different fall directions, as a result of the upright displacement of the blocks. Thus, they produced lateral compressions as secondary tangential movements that led to the disarrangement of strata and their large upwarping under the form of synclines and anticlines, located between the crystalline of Meseş Range and the crystalline of Hăghișa, Zalău syncline, Dobrin - Panic anticline, Crișeni and Aghireș – Panic brachianticlines respectively.

4. CONCLUSIONS

The article aims at highlighting the active and passive role of the geological factor in establishing tectonic and structural relationships in Silvania Mountains. The research began with a restructuring of Silvania Mountains paleodynamics and tectonic evolution *as an Alpine collisional chain*, result of a complex geodynamics, Hercynian on the one hand, mainly Alpine on the other, integrated to the Tisia-Dacia microplate and reduced to these *islands of crystalline schists* (nowadays, Variscan remnants incorporated into the structures of Alpine nappes of the North Apuseni Mountains), against an Alpine disjunctive tectonic style to which the block or craton of Tisia was subject.

The geodynamics of Silvania Mountains and inferientially their structural landmarks are due to the Neogene development of the neighboring Transylvanian and Pannonian Basins, to the post-Eocene translational movements (towards North) and to the large clockwise rotation of the Tisia block around the Moesian plate, against a tight (NNE-SSW) and extensional (E-W) tectonic regime. This is reaffirmed by the *strike-slip type* fault movements of Silvania Mountains.

Silvania Mountains branch out of the North Apuseni Mountains like an *independent chain* as orientation and structure, with an island and V-shaped configuration as a result of the new orientation of the deformations specific to the Middle Miocene-Pliocene, marked by fanwise directions of compression. The emergence of Silvania Mountains system of horsts and grabens is due to the *strike-slip* **type tectonics**, favoured by *Carei-Preluca fault*, through which the Tisia-Dacia Block moves towards East, along the shearing area of the *Mid Hungarian Line* (Carei – Preluca - the North Transylvanian System).

REFERENCES

1. Argyriadis, S. (1975). *Mesogeepermiene chaine herciniene et cassure tethysiene*. Bull. Soc. Geo. France (7), XVII, 156-57.
2. Balintoni, I. (1994). *Structure of the Apuseni Mountains*, Rom. J. Tect. Reg. Geol. 75/2 (ALCAPA II Field Guide Book), 9–14.
3. Balintoni, I., Vlad, S. (1998). *Tertiary magmatism in the Apuseni Mountains and related tectonic setting.* Studia Univ. Babeş-Bolyai, Geologia IX, 1-11.
4. Balintoni, I. (1997). *Geotectonica Terenurilor Metamorfice din Romania*. Edit. Carpatica, Cluj-Napoca, Romania, 176 pp.
5. Balla, Z., (1984). *The Carpathian loop and the Pannonian basin: a kinematic analysis*. Geophys. Trans. 30, 313–353.
6. Clichici, O. (1973). *Stratigrafia Neogenului din estul Bazinului Şimleu*, Edit. Academiei Republicii Socialiste Romania, Bucharest, p. 14-70.
7. Csontos, L. (1995). *Tertiary tectonic evolution of the Intra-Carpathian area: a review*, Acta Vulcanologica, 7 (2), 1-13.
8. Csontos, L. & Nagymarosy, A. (1998). *The Mid-Hungarian line: a zone of repeated tectonic inversions.* Tectonophysics, 297, 51–71.
9. Csontos, L., Márton, E., Worum, G., Benkovics, I. (2002). *Geodynamics of SW-Pannonian inselberg (Mecsek and Villany Mts., SW Hungary): inference from complex structural analysis,* EGU Muller Special Pub. Ser., 3, 1-19.
10. Dallmeyer, R.D., Pană, D.I., Neubauer, F., Erdmer, P. (1999). *Tectonothermal evolution of the Apuseni Mountains, Romania: resolution of Variscan versus Alpine events with 40Ar/39Ar ages*, J. Geol., 107, 329–352.
11. Doglioni, C., Harabaglia, P., Merlini, S., Mongelli, F., Peccerillo, A., Piromallo, C. (1999). *Orogens and slabs vs their direction of subduction*, Earth Science Reviews, 45, 167-208.
12. Fodor, L., Csontos, L., Bada, G., Gyorfi, I., Benkovics, L. (1999). *Tertiary tectonic evolution of the Pannonian Basin system and neighbouring orogens; a new synthesis of palaeostress data*, in Durand, B., Jolivet, L., Horvath, F., Seranne, M. (eds.) *The Mediterranean basins; Tertiary extension within the Alpine Orogen*, Geol. Soc. Spec. Publ., 156, 295-334.

13. Horváth, F. (1993). *Towards a mechanical model for the formation of the Pannonian basin*, Tectonophysics, 226, 333-357.
14. Huismans, R.S., Podladchikov, Y.Y., Cloetingh, S. (2001). *Dynamic modeling of the transition from passive to active rifting, application to the Pannonian Basin*, Tectonics, 20, 1021-1039.
15. Kalmár, J. (1996). *Geology of Szilágysomlyói Măgura*, Földtani Közlöny, 126/1,41-65, Budapest.
16. Konecny, V., Kovac, M., Lexa, J., Sefara, J. (2002). *Neogene evolution of the Carpatho-Pannonian region: an interplay of subduction and black-arc diapiric uprise in the mantle*, EGU Stephan Mueller Special Publication Series, 1, 105-123, European Geosciences Union 2002.
17. Linzer, H.-G., Frisch W., Zweigel P., Girbacea, R., Hann, H.-P., Moser, F. (1998). *Kinematics evolution of the Romanian Carpathians*, Tectonophysics, 297, 133-156.
18. Mac, I., Irimuș, I.A. (2000). *Geomorphological homologies in the mountainous ranges situated in the north-western and south-eastern part of the Transylvanian Basin*, in Bălteanu, D., Ielenicz, M., Popescu, N. (eds.) *Geomorphology of The Carpatho-Balcan region*, Edit. Corint, Bucharest.
19. Meulenkamp, J.E., Kovac, M. and Cicha, I. (1996). *On late Oligocene to Pliocene depocenter migration and the evolution of the Carpathian-Pliocene system*, Tectonophysics, 266, 301–317.
20. Nemčok M., Pospisil L., Lexa J., Donelik R.A. (1998). *Tertiary subduction and slab breakoff model of the Carpathian Pannonian region*, Tectonophysics, 295, 307-340.
21. Nicolae, I. (1995). *Tectonic setting of the ophiolites from the South Apuseni Mountains: Magmatic Arc and Marginal Basin*. Rom. J. Tect. Reg. Geol. 76, p. 27-39.
22. Panaiotu, C. (1998). *Paleomagnetic constraints on the geodynamic history of Romania*. In: Reports on Geodesy. Monograph of Southern Carpathians. CEI CERGOP Study Group No 8, Geotectonic Analysis of the Region of Central Europe. Warsaw Univ. of Technology / Inst of Geodesy & Geodetic Astronomy No 7 (37), 205-216.
23. Panaiotu, C. (1999). *Paleomagnetic studies in Romania; Tectonophysics implications* (in Romanian). PhD thesis, University of Bucharest, 265 pp.
24. Pană, D., Balintoni, I. (2000). *Igneous protoliths of the Biharia lithotectonic assemblage timing of intrusion, geochemical considerations, tectonic setting*, Studia Univ. Babeş-Bolyai, Geologia, XLV, 1, 3-22, Cluj-Napoca.
25. Pană, D. (1998). *Petrogenesis and Tectonics of the Basement Rocks of the Apuseni Mountains: Significance for the Alpine Tectonics of the Carpatian-Pannonian Region,* PhD. Thesis, Univ of Alberta, Canada.
26. Pătraşcu, St., Panaiotu, C., Şeclăman, M., Panaiotu, C.E. (1994). *Timing of rotational motion of Apuseni Mountains (Romania): paleomagnetic data from Tertiary magmatic rocks*, Tectonophysics, 233, 163–176.
27. Păucă, M., Clemens, A. (1964). *Vârsta pietrișurilor piemontane din regiunea de sud a Bazinului Silvaniei,* D . S. Com. Geol., L. ,1.
28. Ratschbacher, L., Frisch, W., Linzer, H.G. & Merle, O. (1991). *Lateral extrusion in the Eastern Alps; Part 2, Structural analysis*, Tectonics, 10, 257– 271.

29. Rădulescu, D. (1984). *Continuity, periodicity and episodicity in magma genesis processes associated to the closing of the Alpine Ocean in the Carpathian Area*, An. Inst. Geo. Geofiz., LXIV, 103-110.
30. Roşu, E., Seghedi, I., Downes, H., Alderton, D.H.M., Szakács, A., Pécskay, Z., Panaiotu, C., Panaiotu, C.E., Nedelcu, L. (2004). *Extension-related Miocene calc-alkaline magmatism in the Apuseni Mountains, Romania: origin of magmas*, Swiss Bulletin of Mineralogy and Petrology, 84/1-2,153-172.
31. Roșu, E., Panaiotu, C., Pécskay, Z., Panaiotu, C.E. and Ivășcanu, P.M. (2000). *Neogene Magmatism in the Apuseni Mountains, Romania. Evolution and geochemical features*, An. Inst. Geol. Rom., 72, 71–72.
32. Royden, L.H. (1993). *The tectonic expression slab pull at continental convergence boundaries*, Tectonics, 12, 2, 303–325.
33. Săndulescu, M. (1994). *Overview of Romanian Geology*, in ALCAPA II field guide book. Romanian J. of Tectonics and Reg. Geol., 75 (suppl. 2): 3-15.
34. Săndulescu, M. (1984). *Geotectonica României*, Edit. Tehnică, Bucharest, 366 pp.
35. Săndulescu, M. (1988). *Cenozoic Tectonic History of the Carpathians*., in: Royden LH, Horváth F (eds.), *The Pannonian Basin; a study in basin evolution*. AAPG Mem, 45, 17-26.
36. Schmid, S., Bernoulli, D., Fügenschuh, B., Maţenco, L., Schefer, S., Schuster, R., Tischler, M., Ustaszewski, K. (2008). *The Alpine-Carpathian-Dinaridic orogenic system: correlation and evolution of tectonic units*, Swiss Journal of Geosciences: doi: 10.1007/s00015-008-1247-3, 139-183.
37. Seghedi, I., Balintoni, I., Szakács, A. (1998). *Interplay of tectonics and Neogene post-collisional magmatism in the Intracarpathian area*, Lithos, 45, 483-499.
38. Socolescu, M., Airinei, S., Ciocârdel, R., Popescu, P. (1975). *Fizica și structura scoarței terestre din România,* Edit. Tehnică, Bucharest.
39. Soroiu, M., Balintoni, I., Vodă, Al. (1985). *A model of the Basement of the Transylvanian Basin as revealed by K-Ar Dating*, Rev. Roum. Geol., Gephys., Geogr., Geophys., 29, 29-35, Romanian Academy, Bucharest.
40. Sperner, B. Ratschbacher, L. & Nemcok, M. (2002). *Interplay between subduction retreat and lateral extrusion: tectonics of the Western Carpathians*, Tectonics, 21/6, I-1 to I–24, 1051, doi:10.1029/2001TC901028.
41. Stan Rodica & Puște, A. (2001). *Un posibil model de evoluție al Munților Apuseni și al sistemului Pânzelor de Biharia,* Studia Univ. Babeş-Bolyai, Geologia, XLVI,1.
42. Strutinski, C., Soroiu, M. (1985). *K-Ar Ages on Rock-Forming Minerals from the Basement of the Southern Pannonian Basin*, Studia Univ. Babeş-Bolyai, Geologia, LV,1.
43. Szadeczky-Kardoss, E. (1925-1926). *Munţii Ascunşi ai seriei cristaline mai vechi (seria I), din nord-vestul Ardealului*, D.S ale Şed. Inst.Geol.Rom, XIV, Bucureşti.
44. Zugrăvescu, D., Polonic, G. (1997). *Geodynamic compartments and present-day stress state on the Romanian territory*, Rev. Roum. Géophys., 41, 3-24.

STUDIA UBB GEOGRAPHIA, LXII, 1, 2017, pp. 29–44
(RECOMMENDED CITATION)
DOI:10.24193/subbgeogr.2017.1.02

LAND USE IN THE AREAS AFFECTED BY GLIMEE-TYPE LANDSLIDES IN THE TRANSYLVANIAN PLAIN. CASE STUDIES: THE LANDSLIDES FROM APATIU, ARCHIUD, BOZIEȘ AND MĂLUȚ

V. V. POP[1]

ABSTRACT. – Land Use in the Areas Affected by Glimee-Type Landslides in the Transylvanian Plain. Case Studies: The Landslides from Apatiu, Archiud, Bozieș and Măluț. A special way of land utilisation in the Transylvanian Plain can be found in areas with glimee-type landslides. Their micro-relief drove people to resort to most various land use methods. From the numerous sites with glimee-type landslides in the Transylvanian Plain, this study focuses on the landslides from Apatiu, Archiud and Măluț. Pastures, hay meadows, orchards and vineyards are among the best represented categories of land use. Knowing the precise area occupied by these categories may offer a valuable insight about the economic importance of these plots of land. Furthermore, we have to stress that recently more and more glimee-type landslides have been included in Natura 2000 protected areas. Such actions help justify the increased attention that must be offered to these areas, economically, scientifically, but also as a tourist attraction.

Keywords**:** *glimee-type landslides, land use, topo-climate, pedogenetic processes, Transylvanian Plain, agricultural reclaiming.*

1. INTRODUCTION

The glimee-type landslides represent a true geographic puzzle considering the number of positive and negative relief forms that occur in such an area, the topo-climatic, hydrologic (including hydrogeology), vegetation, fauna and soil characteristics, as well as land use. Given its generally low economic potential, the geographical features of the relief on glimee-type landslides are very diverse, creating an extremely intricate micro-geographical pattern, under the combined influence of following factors: relief variety, slope orientation, groundwater, soil and vegetation characteristics, and human factors (Gârbacea, 2013).

[1] *Babeș-Bolyai University Cluj-Napoca, Faculty of Geography, 400006, Cluj-Napoca, Romania, e-mail: vassypop@gmail.com*

Generally, the relief bounds interdependently with the topo-climate, the soil properties and vegetation forms, thus influencing land use. Likewise, even a micro-relief may cause differences and discontinuities in the micro-topo-climate, in soils and plant communities, causing sudden changes in soil and plant repartition on the very same, relatively small hillside. A first differentiation occurring in glimee-type landslide sites is that between the warmer and dryer sunlit slopes (oriented toward south, south-west, and south-east), and the shaded slopes (oriented toward north, north-west, and north-east) (Resmeriță et al., 1968). Research carried out in the Transylvanian Plain found that on a south-oriented slope the maximal temperature at ground level reached 52°C, while on the north-oriented slope it was just 27°C, and also registered great rainfall differences between the two slopes (Bujoreanu, 1933, cited by Resmeriță et al., 1968). Under such circumstances, the biomass production will be bigger on the shaded slopes, while the sunlit ones will favour vineyard cultivation.

The uneven terrain created by these landslides shows some features unique to the Transylvanian Plain: hill fronts covered by 5-20% with vegetation, landslides with xerophytic plants, depression alignments holding sometimes standing water, etc., causing a low meadow productivity in both, quantity but especially in quality (Resmeriță et al., 1968).

Likewise, the soils suffer a local replacement. If at regional level argillic chernozems and preluvisols are prevalent, at local level the diversity of geographic factors will result in a large variety of soil types. Consequently, on the scarp walls, given their higher gradient, pedogenetic processes are slower or even stopped by weathering factors, thus staying in the early stages of soil formation. On the earthflow masses, as a result of the mixed bedrock and the uneven slopes, soil forms differently at distances of even several centimeters (Chițu, 1975). In areas with glimee-type landslides there are often found hydromorphic soils, stagnosols, and pellicvertisols in the main depression alignment. On the elongated landslide toe slopes, consisting of clay sands with excess water, there are gleyic chernozems; on sand, sandstone and tuffs there are forming regosols. In secondary depressions there are forming coluvisols, carbonated, highly humificated soils. These types are seen as the best for local fertility classification, as they are not compacted, and the humus forms very thick layers (Gârbacea, 2013).

Topoclimatic, hydro-geologic and pedologic conditions affect not only the occurrence, evolution, and territorial distribution of phytocoenoses, but also their floristic structure. Thus, in the moist basins separating positive terrain forms, vegetation is hygrophilous, as in marsh regions (*Carex, Juncus, Typha, Salix*). The deeper the impermeable rock layer, the more diversified the phytocoenoses, with a further diversification of plant communities due to slope aspect (Resmeriță et al., 1968). Analysing the site from Apatiu, a variation in vegetation is visible for different slope aspects, with shaded hillsides frequently carrying common hawthorn (*Crataegus monogyna*), common dogwood (*Cornus sanguinea*), cornel cherry (*Cornus mas*), hazel (*Coryllus avellana*), hornbeam (*Carpinus betulus*), and even oak (*Quercus robur*), while sunnier slopes are more xerophilous in nature and are usually covered with *Andropogon ischaemum* (fig. 1).

Fig. 1. Land cover differences due to slope orientation

The land use of areas with glimee-type landslides is different from one region to another. In the Hârtibaciu Plateau, for example, a solution to utilise them was to grow fruits on flattened earth masses (Grecu, 1992). At Corunca, they were used differently: those from the first row were planted with fruit trees and black pine (*Pinus nigra*); the second alignment, near the village, is occupied by fruit trees and vineyards, while in the village itself they grow vegetables and vine; cereals and potatoes are cultivated on the fourth and fifth rows (Irimuș, 1998a). Recent research on the utilisation of areas with glimee-type landslides supports the idea of including these terrains in natural protected areas, due to relict species from the post-glacial period, such as *Astragalus excapus*, as well as for landscape reasons due to their morphology (Roșianu et al., 2012).

2. RESEARCH TERRITORY

The case studies are located in hydrographic basins of the 3rd order in the Horton-Strahler system, with the exception of the landslide from Măluț, which lies in a 4th order basin.

The Transylvanian Plain is a major unit of the Transylvanian Basin, located in its middle, being very visibly outlined by the bordering valleys: Someș rivers to the North, Racilor and Zăpodie valleys to the west, the Arieș-Mureș river system to the south, and the Șieu, Dipșa, Lunca and Luț river valleys to the east.

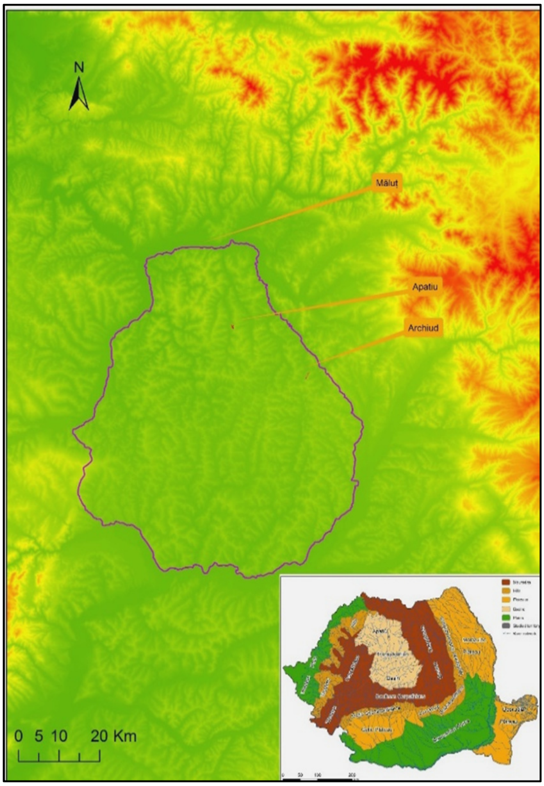


Fig. 2. Location of the studied landslides

This region is considered to hold the majority of glimee-type landslides from the entire Transylvanian Basin. The research undertaken by Moldovan Monica and her team on glimee-type landslides in Transylvania mapped 480 sites, from which 59.2% are located in the Transylvanian Plain (Moldovan, 2012). Their high occurrence is linked to the alternation of sands with marl and clay in the Tortonian and Pliocene deposits (Ciupagea et al., 1970).

Geologically, the Transylvanian Plain is characterised mainly by Tortonian deposits, with two distinct facies: a littoral one, with conglomerates and sandstone, and a bathyal facies, with sands and marl clay (Săndulache et al., 1964), while Pliocene deposits occur mainly in the south-western part. The Tortonian layer usually comprises violet-grey marl with sand intercalations, besides which there occur loose sandstone, and frequently alternating, thin layers of sands and sand marl. Within these Tortonian layers there are intercalations of dacitic tuff, whose thickness ranges from a few millimetres to several meters (Vancea, 1960).

Regarding land use in the Transylvanian Plain, over 90% is agricultural land, of which 60% is arable land and 30% pastures and hay meadows, while forests cover approximately 9%, with significant regional disparities (Pop, 2001). The importance of utilising the areas with glimee-type landslides resides exactly in their high occurrence rate in this landform unit.

3. METHODOLOGY AND DATA USED

Regarding the methods applied, we conducted topographical surveys on site using a GPS Trimble R4 device running GNSS technology. Following the measurements, we used the ArcGIS application to draw the geomorphological maps of sites with glimee-type landslides. The areas showing each land use category were extracted from the physical blocks of each plot registered at APIA (the Agricultural Payment and Intervention Agency). All these elements were superimposed on 2012 aerial images.

4. RESULTS

4.1. The landslide from Apatiu

The landslide site is located within the administrative borders of Apatiu, on the right slope of the Apatiu Valley, in the Meleș Valley Basin, a tributary of Someșul Mare River.

In cross section, the terrain shows three sectors, with distinct morphologic, morphometric, and functional features: the scarp, the flowage zone, and the toe. The main **scarp front** has a length of 800 m and a fall 25-50 m in height. The scarp front is still active and is affected by new glimee-type landslides that bulge at the base of the front, making the transition to the depression alignment.

These new landslides are in their incipient phase and are much smaller, given present-day climatic conditions. The **glimee ridges complex** lies at the bottom of the slump zone, forming five parallel rows that started to fall apart even during the slide. The ridges have various sizes and are separated by micro-depressions, some of which are larger, while others are not so visible. The largest ridges are those from the 2nd and 3rd rows, showing relative heights of about 20-25 m. Presently, the first row is affected by a strong re-fragmentation (fig. 3), resulting in a new landslide mass of the same length separated from the originating body by a 3-4 m deep trench, indicating a new depression alignment (fig. 3) (see also Pop, 2015).

Fig. 3. The newly formed depression alignment

Regarding the land use of the site, there is an important agricultural reclamation, with permanent pastures still prevailing (fig. 4). The spatial distribution of these pastures is effected by the great extent of transversal depressions and of humid areas in horizontal areas. The prevalence of permanent pastures to the detriment of arable land can be explained simply by the fact that it is not feasible to cultivate small, mostly low-productive parcels. Another explanation could be the distance to the village.

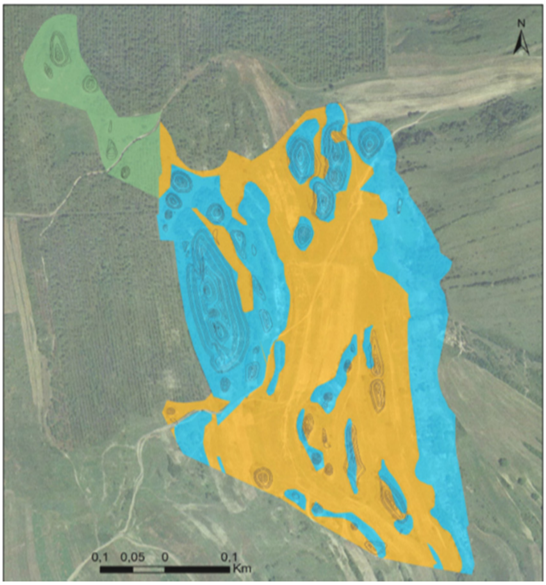


Fig. 4. Land use within the site with glimee-type landslides from Apatiu, according to APIA data, 2015 (green: permanent crops, others than vineyards, orchards, etc.; blue: non-productive land, covered with reed and bulrush, or marsh vegetation; orange: permanent pastures)

Due to relatively high altitude differences between the transversal depressions and the conical forms with steep slopes, ridges and scarps, these terrains are considered to be non-productive (fig. 4). It must be mentioned that the current land use mode within this landslide site is implemented according to the annual inventory of the Agricultural Payment and Intervention Agency (APIA), in this case for the year 2015.

It is interesting to observe the comparison between the land use before and after the year 1989. Until 1989, the land was cultivated on large parcels through Agricultural Production Cooperatives (APCs), and most of this landslide site was classified, according to the agricultural registry from 1989, as non-productive land, being used as pasture. The frontal side of the landslide was levelled in 1984 and a plum orchard was cultivated on its base, including the higher ridges in the plantation (fig. 4). After 1989, with the dissolution of the APCs and the privatisation of the land, there occurs a change in land use, with some of the transversal depressions being transformed in arable land with a crop rotation system, the main cultures being corn, wheat, and potatoes.

The agricultural reclamation rate in the landslide site is shown in figure 5. From a total of approximately 42 hectares, 42.13% is non-productive land, 49.42% are permanent pastures, and a small part – 8.44% – is cultivated. This distribution is due to a relatively large number of ridges with a high drop toward the depressions and steep slopes.

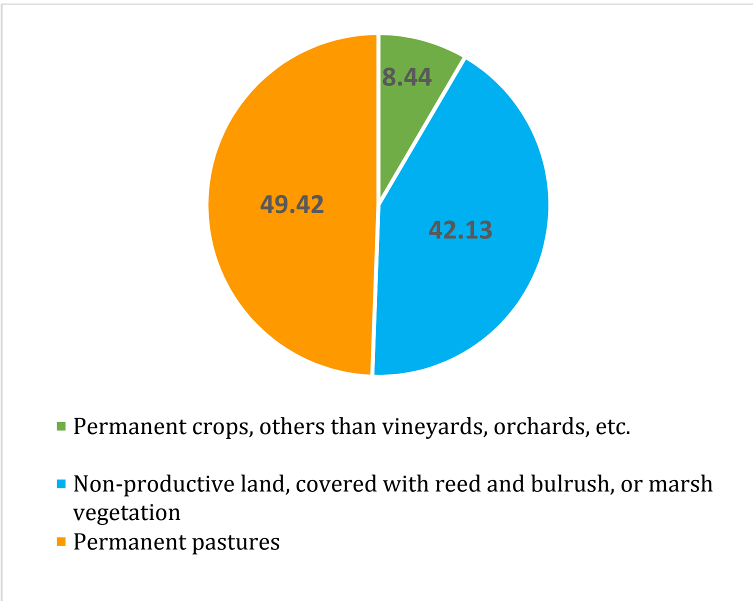


Fig. 5. Agricultural reclamation rate and land use of the glimee-type landslide from Apatiu

4.2. The landslide from Archiud

The glimee-type landslide from Archiud is located to the east of the village, in area called „La Ciurgău”. Administratively, Archiud is part of Teaca commune, Bistrița-Năsăud County, in the Dipșa Valley basin.

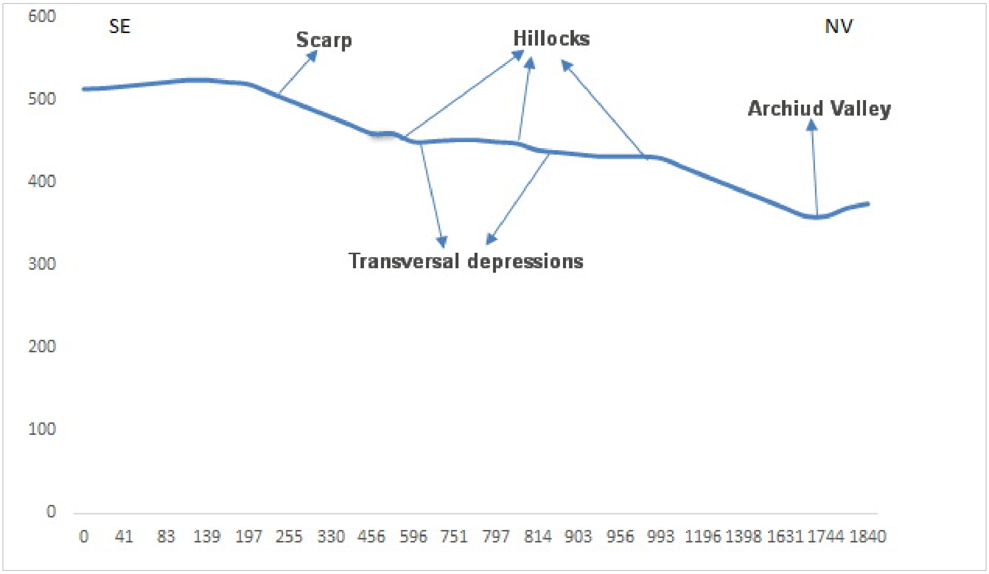


Fig. 6. Profile of the landslide from Archiud

The landslide comprises a forested fault scarp of 1.7 km in length, three hillock alignments parallel to the scarp, and very visible transversal depressions (fig. 6). The total area affected by landslides covers over 98.5 hectares.

The scarp lies at approximately 500 m in a watershed region. It has a drop of sometimes 45-50 m. Its surface is affected by rain wash, gully erosion, and falls, processes that are amplified by massive deforestation on the hillside (fig. 7).

The landslide mass shows three rows of hillocks, extending parallel to the scarp and the transversal depressions. Their height drops from the scarp towards the front, with the highest being those from the last landslide alignment. The latter appears as a long range of about 1080 m and a drop of 10-12 m towards the depressions (fig. 8).

Fig. 7. The scarp of the landslide from Archiud, showing signs of deforestation

Fig. 8. Uniform hillock alignment and transversal depression

The other rows are more fragmented and smaller, disappearing towards the front of the landslide. If the landslide as a whole is in a clear state of equilibrium, that is not the case of the hillocks, with dynamic morphological processes, such as falls, gully erosion, rain wash, and radial erosion, that are modelling these relief forms (fig. 9). Most hillocks are covered with grass and clusters of dog-rose (*Rosa canina*), blackthorn (*Prunus spinosa*), and sea-buckthorn (*Hippophae rhamnoides*), some of them showing on their southern slopes vineyards, nowadays mostly abandoned (Gârbacea, 2013).

Fig. 9. Present-day erosion of the hillocks

Between the scarp and the hillocks there are the transversal depressions, the first of them situated between the last ridge and the scarp gradually increasing in width from 40 m at the east end to 95 m in the west, with a small incline from NE to SW. It is used as a pasture and at its contact with the hillock range there are spheroid Tortonian sarsen stones (fig. 10).

The width of the other depressions increases from 20-40 m in the east to 115-140 m in the west. A part of these depressions are cultivated with corn, wheat and alfalfa (*Medicago sativa*), some parts as hay meadows and pastures, while lower hillocks are used to grow fruits (mostly plume) and wine (fig. 11). At the west end of the site, the depressions are occupied by farms, that climb to the top of the hillocks. Due to their geological structure (clay, marl, and sands), some hillocks are used as source for building material (fig. 11).

Analysing the 1:5000 scaled topographical maps of the region we can learn that, prior to 1989, the most part of the site was used as pasture and hay meadow, a fact supported by the presence of three sheepfolds at the east end of the site, while the arable land extended in the vicinity of the village (fig. 12a).

Changes in land use are due to re-privatisation following the dissolution of the APCs after 1989, that triggered an expansion of arable land, a part of the pastures and hay meadows being cultivated with corn and wheat, as the sheepfolds become gradually deserted and the vineyards are increasingly ignored.

Fig. 10. Tortonian spheroid formations

Fig. 11. Complex land use of the glimee-type landslide site

At the present time (2015) the land use is showing signs of a return to its pre-1989 state, excepting the sheepfolds, due to population decrease and ageing in the village; high agricultural costs; and no viability of cultivating small land parcels. From the total area of 90 hectares, 54.06% are used as pastures, 27.5% are non-productive, 1.09% is arable land, 0.91% are roads, and 0.55% are covered by farms and buildings (fig. 12b).

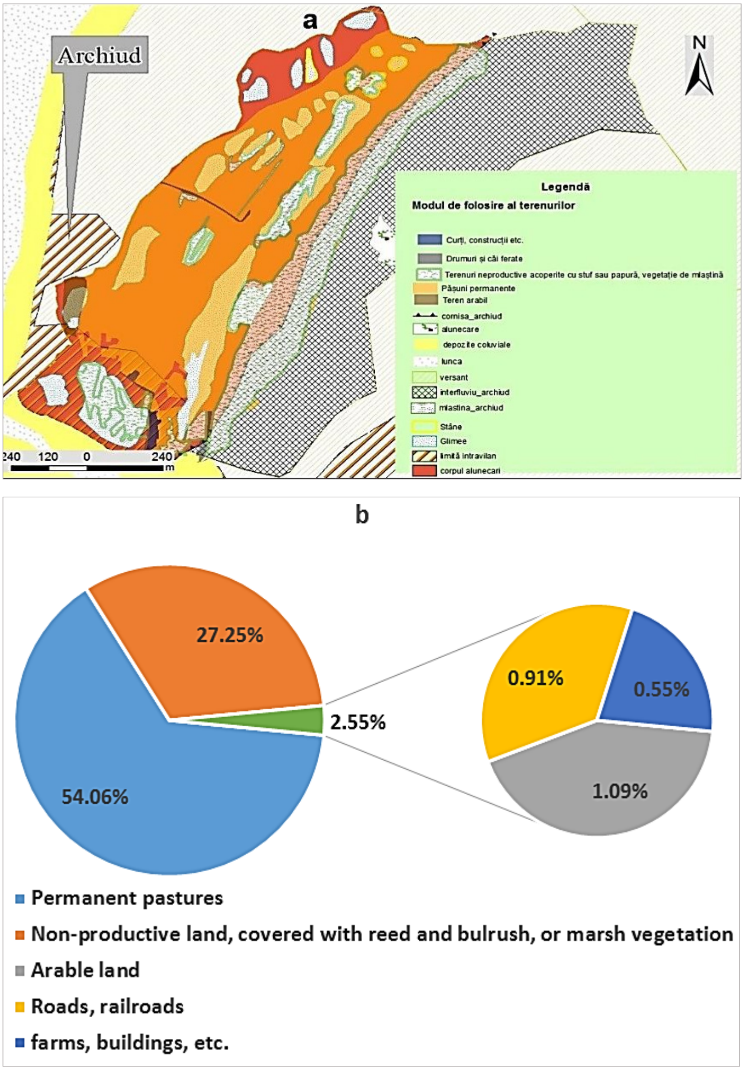


Fig. 12. Land use within the glimee-type landslide from Archiud, according to data from APIA, 2015 (a); agricultural reclamation rate in the site from Archiud (b)

4.3. The landslide from Măluț

The landslide area is known by the locals as „the giants' graves" and is situated on the southern hillside of the Ungurașu and Cireșoaia Hills, in the region called „La Strigăi", south-west from Măluț, in the Someșul Mare Valley. Being positioned on a monocline structure with strata falling from south to north, the landslide is a consequent one, formed through translational processes. Its profile shows three sectors with distinct morphologic, morphometric, and functional characteristics: the secondary scarp, the hillock complex, and the front of the earthflow.

Fig. 13. The secondary scarp with hillock rows and transversal depressions

The secondary scarp is a 200 m long, L-shaped fault (fig. 13). On much of its surface, the stratification of the Tortonian deposits, with their northward incline, is visible. In longitudinal section, the watershed extends as a saddle between 382 and 380 m, respectively (fig. 14). This fact gives us reason to conclude that the landslide developed in two stages, the first giving birth to the hillocks in the first row, right behind the front of the landslide, while in the second stage, the hillocks beneath the secondary scarp were formed. During the second stage, a main scarp still existed, but is nowadays visible only as an anticline.

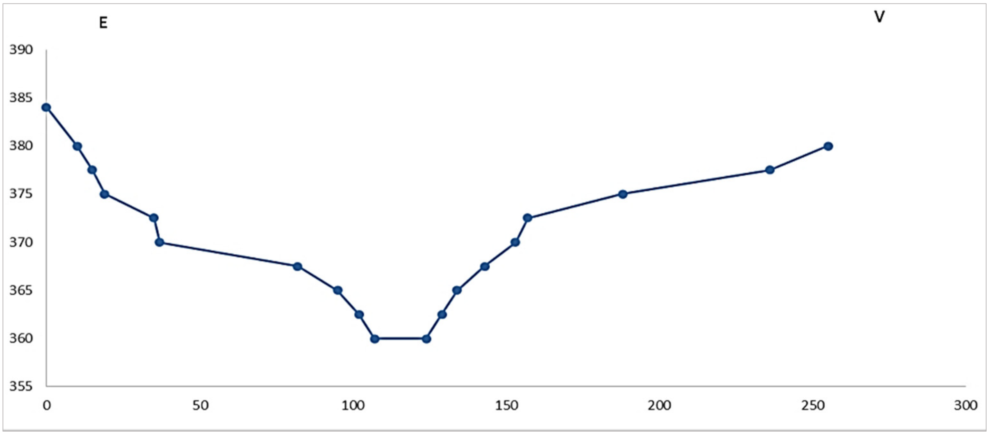


Fig. 14. Longitudinal section of the watershed

The transition from the secondary scarp to the hillock rows is made through a very narrow depression alignment (fig. 13), where traces of the existence of a small, now closed, pond are still visible. Its place is indicated by reed and the puddles that form during rainy periods. Compared to this alignment, the micro-depressions between the hillock ridges are deeper and larger.

The glimee rows complex formed by the landslide comprises two parallel alignments of compact ridges and several compact, randomly placed hillocks that started to already erode during the slide. Although some of them appear currently isolated, this is due later rain wash, ridging, mudflow and other erosional processes.

Most of the hillocks are covered with grass, and shrubs of common hawthorn (*Crataegus monogyna*), dog-rose (*Rosa canina*), and blackthorn (*Prunus spinosa*). There is also wildlife represented by birds such as pheasant, mammals like wild boar, roebuck, rabbit and fox, and frogs and lizards in wet areas.

The largest hillocks are those within the two alignments, with relative altitudes of 5-10 meters. Presently, the second row is affected by rain wash and is fragmented in two parts separated by a niche with an alluvial fan at its base. On some hillocks there can be seen small ruptures that, in time, will fragment the ridges. Because of their shape, these forms are known in local toponymy as giants' graves.

The front of the landslide is represented by the first ridge, that ends in a rounded toe over the hillside. It is also possible that human activity contributed to its flattened shape.

Regarding the land use in this landslide area, its entire surface is classified by APIA as non-productive land, covered with reed and bulrush, and only occasionally used as pasture (fig. 15). Analysing the 1:5000 scaled topographical maps, 1984 edition, it shows that in that period most of the landslide site was still non-productive, with pastures and orchards extending in its proximity.

The low land use rate within this landslide, as compared with the first two case studies, can be explained by the fact that the village is located in the floodplain and on the terraces of the Someșul Mare River, thus in plain areas with high agricultural potential, and also by the greater distance from the village, of approximately 2 km.

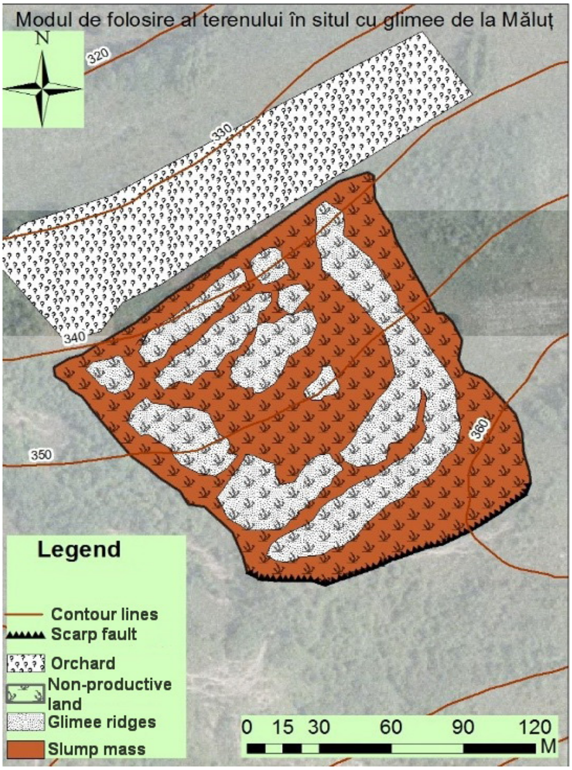


Fig. 15. Land use of the landslide from Măluț, according to data from APIA, 2015

5. CONCLUSIONS

Following the field research in the area of the three glimee-type landslide sites, we can conclude that there are landslides that are primary used as pastures (Măluț), or that have a more complex usage (arable land, pastures, fruit and vine growing, etc). There are such landslides with high agricultural utilisation (Archiud and Apatiu), or landslides with no significant agriculture (Măluț) except for occasional grazing. However, the most parts of glimee-type landslides are used as pastures. The land use and agricultural reclamation rate also depends on their distance to the nearest village. Before 1989, land use was conditioned by the form of land ownership, namely collective property of the APCs, where terrain cultivation was done on large areas, and landslides, with their small area, had been catalogued as non-productive and thus used as pastures. As land once again became private after 1989, there starts a complex agricultural reclamation of the glimee-type landslides, with a significant part of their area gaining agricultural usefulness.

REFERENCES

1. Chițu, C. (1975). *Relieful și solurile României*, Edit. Scrisul Românesc, Craiova.
2. Ciupagea, D.T., Paucă, M., Ichim, T. (1970). *Geologia Depresiunii Transilvaniei*, Edit. Academiei Republicii Socialiste România, București.
3. Gârbacea V. (2013). *Relieful de glimee*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
4. Grecu, Florina (1983). *Alunecările de la Movile*, Ocrot. nat. med. inconj., 27, 2.
5. Grecu, Florina (1992). *Bazinul Hârtibaciului*, Edit. Academiei, București.
6. Irimuș, I.A. (1998a). *Alunecările de teren de la Corunca și implicațiile în organizarea spațiului geografic*, An. Univ. „Dimitrie Cantemir", Șt. Socio umane, II.
7. Jakab, S. (1972). *Observații pedogeografice și pedomorfogenetice în Câmpia Transilvaniei*, Șt. Sol., X, 3.
8. Moldovan, Monica (2012). *Glimeele din Transilvania*, PhD thesis, Cluj-Napoca.
9. Pop, V.V. (2015). *Landslides from Apatiu, Meles Basin (Transylvanian Plain),* Revista de Geomorfologie, 17, București.
10. Resmeriță, I., Csuros, Șt., Spârchez, Z. (1968). *Vegetația, ecologia și potențialul productiv pe versanții din Podișul Transilvaniei,* Edit. Academiei, București.
11. Resmeriță, I. (1971). *Rezervația botanică de la Suatu*, Ocr. Nat., 15, 2, București.
12. Săndulache, Al., Diaconeasa Băluţă M., Beju, D. (1964). *Contribuţii la studiul originii lacurilor dulci din Câmpia Transilvaniei*, Cluj.
13. Șoneriu, I. (1973). *Aspecte ale valorificării agricole și silvice a terenurilor afectate de alunecări din partea central estică a Podișului Târnavelor*.
14. Vancea, A. (1960). *Neogenul din Bazinul Transilvaniei*, Edit. Academiei Republicii Populare Române, București.

STUDIA UBB GEOGRAPHIA, LXII, 1, 2017 (p. 45-57)
(RECOMMENDED CITATION)
DOI:10.24193/subbgeogr.2017.1.03

RELATIONAL ANALYSIS OF SUSCEPTIBILITY TO LANDSLIDES OF SETTLEMENTS SITUATED IN THE EASTERN AND CENTRAL PART OF ALBA IULIA HINTERLAND, USING GIS TECHNOLOGY AND MAXENT SOFTWARE

A.S. NICULA[1], KEREKES ANNA-HAJNALKA[2], V. V. POP[2], GH. ROȘIAN[3]

ABSTRACT. – Relational Analysis of Susceptibility to Landslides of Settlements Situated in the Eastern and Central Part of Alba Iulia Hinterland, Using GIS Technology and MaxEnt Software. Relational analysis is an important method to analyze, generate and to predict relevant data about natural or men-made hazards. In this study, we have chosen to investigate different relations between landslides and landslide causing factors, interpolating the results and their impact on settlements. Urban and rural settlements are highly prone to landsliding because of the increased population which lives in the affected territories. Therefore, an assessment of landslide susceptibility becomes an important phase to predict the most vulnerable settlements of a certain territory in order to implement different disaster mitigation plans/works and land planning strategies. Our study area has a high tendency to landslide due to its lithological and morphological structure. Thus, our purpose is to generate a reliable and accurate analysis of the settlements using the susceptibility map generated by the MaxEnt software, based on 8 identified landslide causing factors: slope angle, slope aspect, profile and plan curvature, terrain roughness, depth of fragmentation, precipitation and temperature. The resulted map indicates a high value of accuracy, the area under the curve (AUC) showing a high performance (0.925) of our analysis.

Keywords: *vulnerability, settlements, GIS, MaxEnt, Alba Iulia, hinterland, ROC curve.*

[1] *Babeș-Bolyai University, Faculty of Geography, Centre for Research on Settlements and Urbanism, Cluj-Napoca, Romania, sabin.nicula@gmail.com*
[2] *Babeș-Bolyai University, Faculty of Geography, Cluj-Napoca, Romania*
[3] *Babeș-Bolyai University, Faculty of Environmental Science and Engineering, Cluj-Napoca, Romania*

1. INTRODUCTION

Landslides are the most destructive men-made or natural hazards leading to increased vulnerability of affected settlements, therefore causing significant damages in property, land-use and infrastructure. According to Surdeanu (1998), in Romania, landslides, as natural disasters, have the highest occurrence frequency.

Vulnerability of urban and rural settlements represents a highly studied actual issue because of the increased world population (75%) which lives in areas prone to natural and men-made disasters (*Reducing Disaster Risk*, *A Challenge for Development*, United Nations Development Programme, 2004). High vulnerability stays in a strong relationship with a greater tendency to disasters, therefore the lack of infrastructure, hazard mitigation works and land planning strategies lead to high values of susceptibility and risk.

The aim of our study is to describe a relational analysis between settlements and down-slope movement. The most significant down-slope movement of this territory is the land sliding, which will be analyzed in our study using different methods, like the principle of maximum entropy and geospatial analyst tools. Another purpose of our study is to highlight the vulnerability to the existent landslides of the settlements from the Eastern and Central part of Alba Iulia hinterland. Landslides cause the most significant impact and have the highest dynamism from down-slope processes, thus, it becomes necessary to perform a prediction of the total vulnerable area. We decided to analyze the eastern part of the Alba Iulia hinterland due to its particular lithological and morphological structure, and through of the high frequency and dimension of the existent landslides, it transforms this area into a veritable hotspot of down-slope movement. In recent years, many methods were used and analyzed to generate valid susceptibility predictions of a certain area. The principle of maximum entropy was used successful in generating valid susceptibility analysis (Davis and Sims, 2013; Felicisimo et al., 2012; Davis and Blesius, 2015) and according to E.T. Jaynes, it represents the best approach, having high ROC values. Based on these reasons, we required to use the MaxEnt software to generate this kind of prediction, thus, we can make further analysis of the settlements included in the studied territory.

In our analysis, we used 8 parameter maps and realized an overlay with the susceptibility map and the existent situation in order to see which settlements are affected by landslides and which are prone to this disasters.

2. STUDY AREA

The hinterland of Alba Iulia was delimited using multicriterial approach, based on teorethical (GIS modeling) and empirical analysis (Nicula et al., 2015).

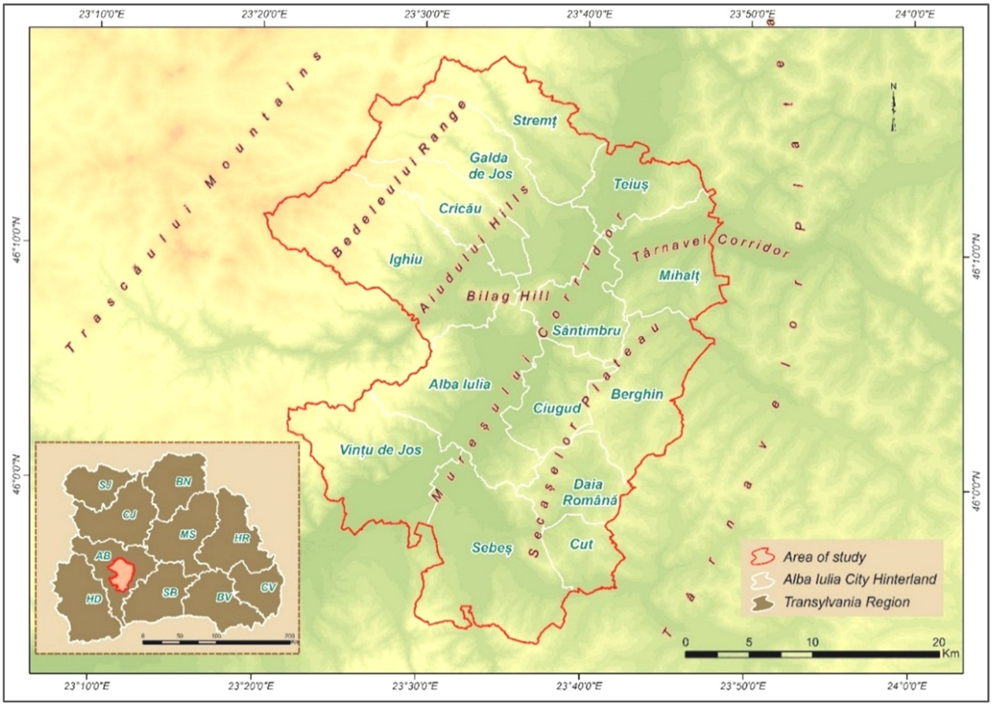


Fig. 1. Geographical position of the studied area

Our study area represents the Eastern and Central part of Alba Iulia hinterland (Fig. 1). We can observe a landslide hotspot on this territory, the majority of them being present on the Secaș (Gorganu-Gruiu) and Cergău Plateau, caused by the frequency of Pannonian depositions (depositions with high porosity). The frequency of landslides is reduced in the western part of the hinterland (which is dominated by mountains). The Alba Iulia-Aiud-Turda Corridor separates the two parts of our study area, and the connection between the Corridor and mountains is being realized by wooded slopes, characterized by the absence of land sliding. The above mentioned facts are the main reasons why we have chosen the Eastern part to investigate.

From regional point of view, our territory overlaps two mains relief units: the unit of mountains (Trascău Mountains) and hills from the western part of the Secaș Plateau and the Mureș Corridor, with the Alba Iulia-Aiud-Turda sector. The area under investigation contains 13 territorial administrative units, from which 11 is affected by land sliding.

From a morphologic point of view, we can observe a gradual transition of the relief units, from the mountain and hill/plateau units from the west (Ampoi Mountains, Bedeleu Massif, Aiud Hills) and East (Secaș Plateau) to the central part of the territory, represented by the Mureș Corridor. The Alba Iulia-Aiud-Turda (Mureș) Corridor represents a significant relief unit, with an elongated form, and a total length of 110 km (Pop, 2012). In the noth-western part, the connection between the Bedeleu Massif and the Alba Iulia-Aiud-Turda Corridor is realized gradually, with the interposition of Aiud Hills. In the case of the Ampoi Mountains, they have a discrete connection with the same Corridor.

Therefore, the territory is separated in two main areas by the Alba Iulia-Aiud-Turda Corridor: the western part, dominated by mountains, and the eastern part, dominated by plateaus.

3. METHODOLOGY AND DATA COLLECTION

In order to generate a landslide susceptibility map, which becomes useful in the prediction of the total vulnerable area of the settlements (this is our main purpose). First, we need to identify the existing landslides (landslide inventory, fig. 2) and the causative factors of this disaster (Roșian, 2009). For generating relevant parameter maps, we used ArcGIS 10.2.2 software.

The first step is represented by the vectorization of the landslides and settlements, using satellite imagery and aerial photographs (source: ANCPI, Google Earth), respectively Open Street Map. A number of 228 landslides were identified, 8 from them affecting 5 settlements: Cistei, Cut, Berghin, Hening and Obreja. This territory contains a number of 52 settlements, therefore 9.61% of them are affected by landslides.

The total surface of landslides is equal with 3489.308 ha and 0.22% of the affected surface can be found on the territory of the settlements.

The second step includes the preparation and generation of the parameter maps, representing the landslide causing factors. For the selection of the main causal factors, we need to consider the nature of the study area and the availability of the data, also we need to be assured about the fact that that the selected parameters are useful, complete, measurable, varying spatially and non-redundant (Yalcin, 2008).

Therefore, we considered the following parameters, by consulting the literature: slope, aspect, terrain roughness, depth of fragmentation, plan and profile curvature, temperature and precipitation (Bayes, 2015; Chen et al., 2016; Chung et al., 2016; Conforti et al., 2011; Pradhan and Lee, 2010).

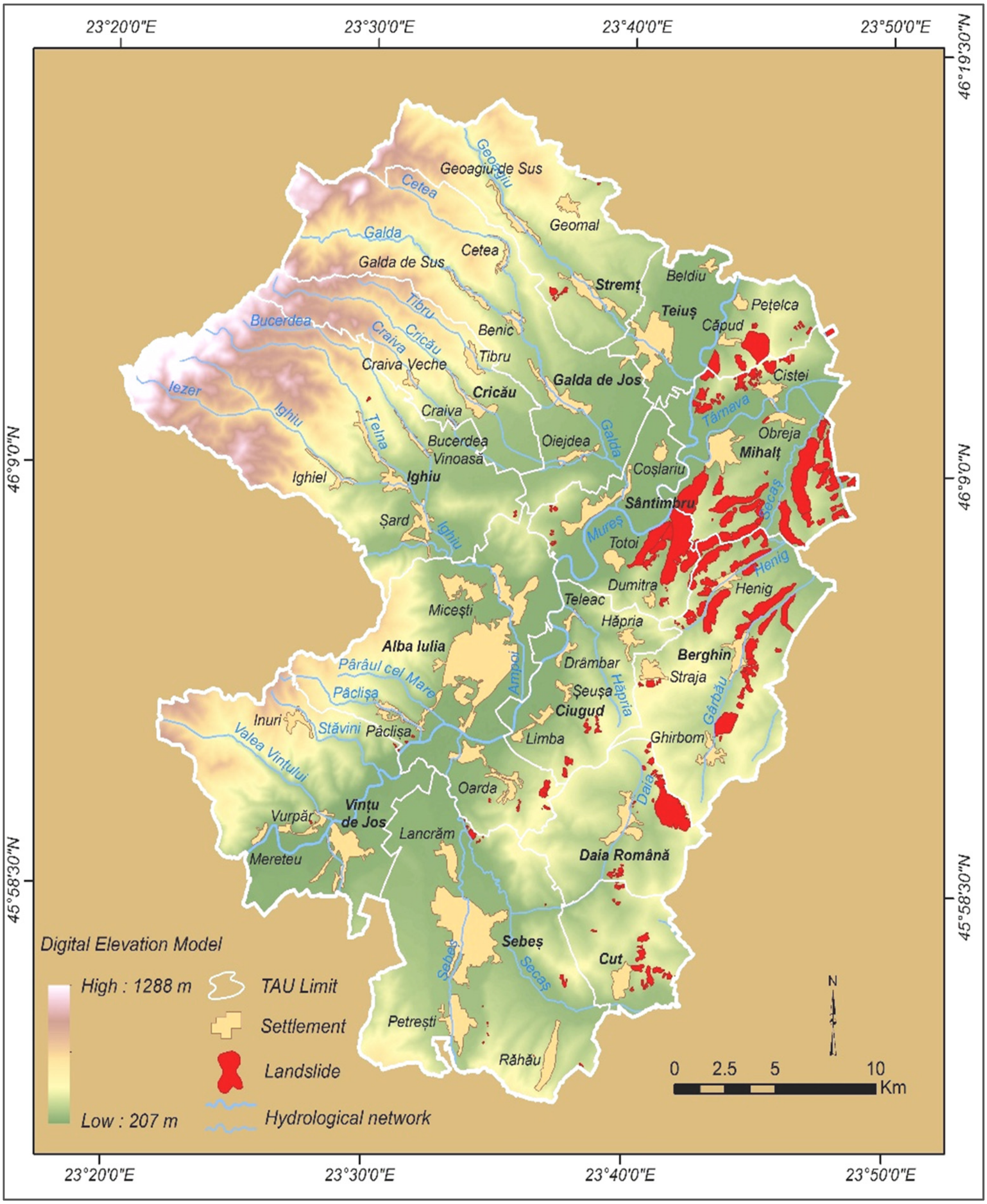


Fig. 2. Landslide and settlements inventory. The current situation

The spatial database used in our research is represented in Table 1.

Table 1. Spatial database

No.	Name	Type	Structure	Source
1	Landslide inventory	Vector	Polygon	Aerial orthophotograms and satellite imagery
2	Settlements	Vector	Polygon	OSM
3	Precipitation	Raster	Grid	National Administration of Meteorology, Romania
4	Temperature	Raster	Grid	National Administration of Meteorology, Romania
5	Slope	Raster	Grid	DEM (30x30) derived
6	Aspect	Raster	Grid	DEM (30x30) derived
7	Depth of fragmentation	Raster	Grid	DEM (30x30) derived
8	Profile and plan curvature	Raster	Grid	DEM (30x30) derived
9	Terrain roughness	Raster	Grid	DEM (30x30) derived

In our study, we identified a number of 6 landslides causing DEM (Digital Elevation Model)–derived parameters: slope angle, slope aspect, depth of fragmentation, profile and plan curvature and terrain roughness. All DEM derived parameters were generated by using the Spatial Analyst tool. Moreover, we identified 2 climatological factors, which contribute to the appearance of this disaster: temperature and precipitation, which were generated by Kriging interpolation.

Slope angle is the most influencing factor of land sliding, because all processes which are caused by the gravitational force occur under specific conditions and slope angle. Also, this parameter is frequently used in landslide susceptibility analysis (Pradhan and Lee, 2011; Chung et al., 2003). The slope parameter map was classified in 6 intervals: 0-2^0, 2-5^0, 5^0-10^0, 10-15^0, 15-25^0, >25^0. Analyzing the results, we can conclude the fact that most landslides from the area of settlements occurred between 5-10^0.

Slope aspect is an important factor by influencing the exposure to sunlight, rainfall or drying winds (Pradhan and Lee, 2010; Conforti et al., 2011) thus the degree of saturation and the quantity of solar energy are unevenly distributed on the study area: slopes with south, south-eastern and south-western orientation receive more solar energy thus becoming less saturated with moisture. This parameter describes the direction of slope (Chen et al., 2016). This thematic layer was grouped into 13 classes: flat (-1), north (337,5^0- 360^0, 0^0-22,5^0), north-east (22.5^0–67.5^0), east (67.5^0–112.5^0), south-east (112.5^0–157.5^0), south (157.5^0–202.5^0), south-west (202.5^0–247.5^0), west (247.5^0–292.5^0), and north-west

(292.5^0–337.5^0). Analyzing these groups, we can say that the most affected slopes of the settlements are the south-eastern ones.

Depth of fragmentation represents the relative altitudinal difference for a specific area. In our study, this thematic map was grouped into five classes, seen in Fig. 3. Most landslides which affect settlements occurred between values of 0-100 m.

Profile and plan curvature represent the shape of surface, negative curvature values represent concave, positive curvature values represent convex surface (Pradhan and Lee, 2010). We used the natural breaks method to classify our maps in 5 classes, as we can see in Fig. 3. In the case of profile curvature, most landslides of the settlements occurred between -0.16-10 m^{-1}, respectively -0.16-0.06 m^{-1} in the case of plan curvature.

According to Riley et al., 1999, **terrain roughness** represents a terrain ruggedness index, which quantifies topographic heterogeneity. The thematic layer was classified into five groups, using the natural jenks distribution: 0.0056-0.33m; 0.33-0.43m; 0.43-0.51m; 0.51-0.60m; 0.60-0.91m. Most landslides which affect the settlements occurred in the second group.

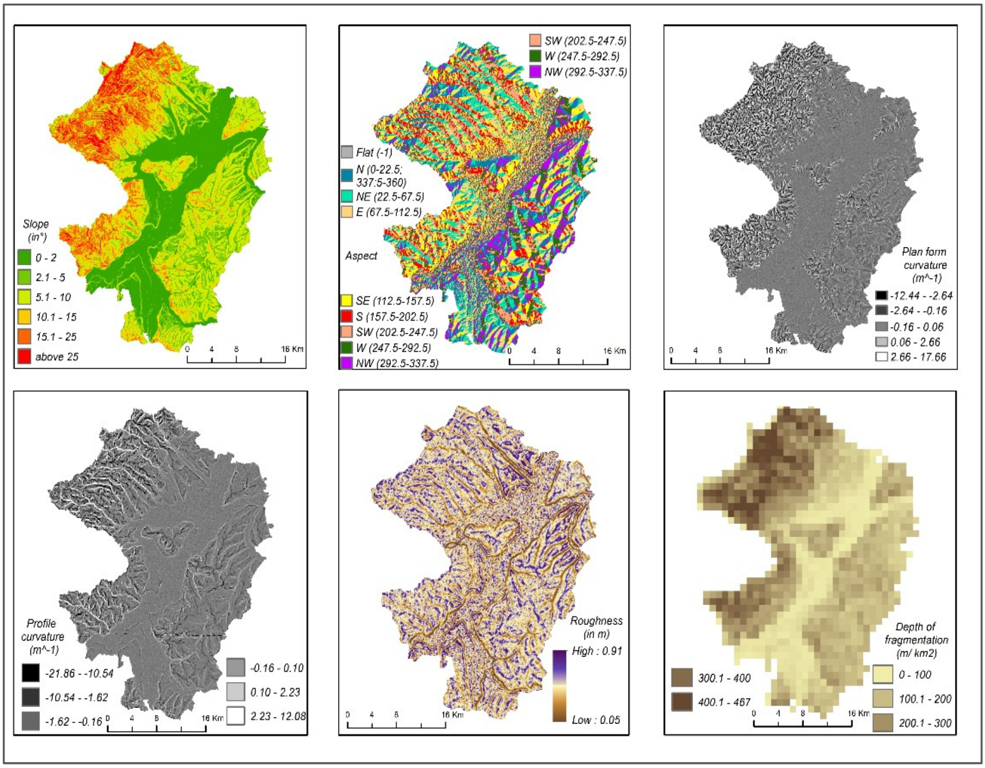


Fig. 3. Landslide causing parameters

The precipitation and temperature map (Fig. 4) was prepared by using the last 5 years rainfall data. We realized an average annual rainfall and temperature map using Kriging interpolation. Precipitation and temperature are landslide triggering factors, contributing to slope instability: freeze-thaw and wetting-drying processes, intense rains influences the down-slope movement. The most affected settlements have an average annual temperature between 9-9.5 C⁰ and an average annual precipitation between 900-1000 mm.

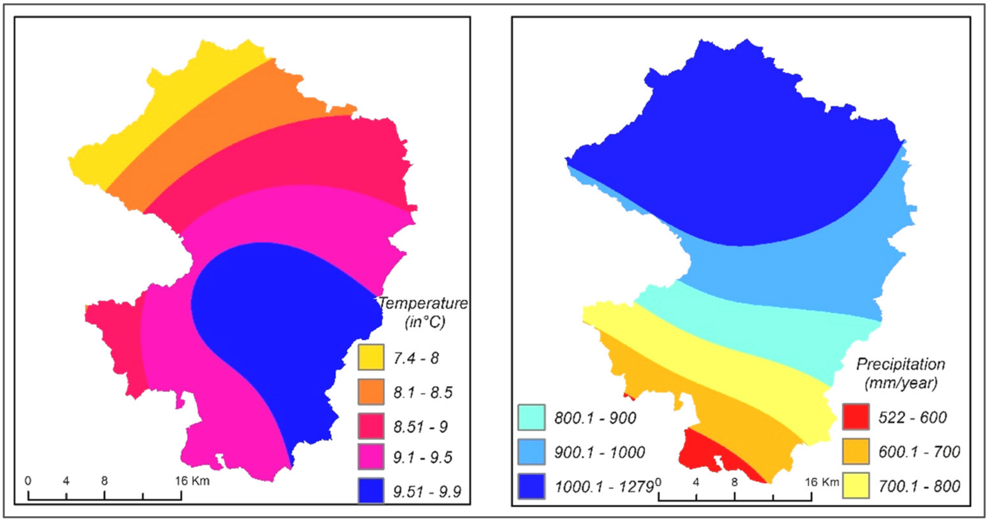


Fig. 4. Temperature and precipitation map

Using these parameters, we required to the next step, the spatial analysis, generating a valid susceptibility map, which represents the base for further research, presented in this study.

4. SPATIAL ANALYSIS

Spatial analysis is the most important phase-in receiving a valid susceptibility map. In our study we used the MaxEnt software to generate a reliable landslide susceptibility map, which is based on the Maximum Entropy Principle.

The Maximum Entropy Principle was used in several studies, mainly for species distribution, but in the last years it was successfully applied for analyzing landslide susceptibility. According to Philiphs et al. (2005), E.T. Jaynes claimed: "the best approach is to ensure that the approximation satisfies any constraints on the unknown distribution that we are aware of, and that subject to those constraints, the distribution should have maximum entropy" (Jaynes, 1957).

While running the software, all thematic layers, which were generated by the Spatial Analyst tool, were used and analyzed by the MaxEnt software. After this, we received a valid landslide susceptibility map, and the resulted values were classified into five groups (using the natural breaks distribution): very low, low, moderate, high and very high probability class of landsliding occurrence (Fig. 5).

5. RESULTS AND VALIDATION

Analyzing the resulted map, we could predict by using the overlay tool the fact that 5.49% of the existent settlements will be affected by landslides. According to the susceptibility map classification (Fig. 5), areas with very high and high tendency for landsliding are situated in the eastern, north-eastern part of the hinterland. Therefore, we realized a classification of the settlements, to predict which are the most vulnerable.

The classification was made by using the overlay tool. For every settlement we calculated the total area which is the most prone to landslides (very high and high susceptibility classes), and these values were divided with the total surface of the settlements. Therefore, we obtained values between 0 and 1. The most vulnerable areas, which have values above 0.1, are: Berghin (0.244), Căpud (0.104), Cistei (0.27), Daia Română (0.19), Drâmbar (0.27), Dumitra (0.42), Ghirbom (0.26), Hăpria (0.31), Henig (0.34), Ighiel (0.101), Mihalț (0.12), Obreja (0.14), Pâclișa (0.27), Pețelca (0.18) and Straja (0.30). Moderate values means values between 0.1 and 0.01 (in total 11 settlements), moderate-low values means values below 0.01 (in total 9 settlements) and low susceptibility class of settlements means that those settlements are not prone to further landslides.

The validation of the susceptibility map is an important step, because in the lack of this phase, we cannot decide if our analysis is valid or not and it also checks the predictive capability of the produced map (Chung and Fabbri, 2003). The MaxEnt software generated a receiver operating characteristic curve (ROC curve), which is used for testing the reliability of our research (Roșian et al., 2016). We apply the area under the curve (AUC) method. AUC values between 0.7 and 0.9 indicate reasonable discrimination ability and values higher than 0.9 represent a high accuracy of the classification (Swets, 1988). Values below 0.5 represent a poor performance of the applied. Our software generated a ROC curve, the AUC value was estimated to be 0.925 (Fig. 6), which indicates a high accuracy and reliability of our methodology.

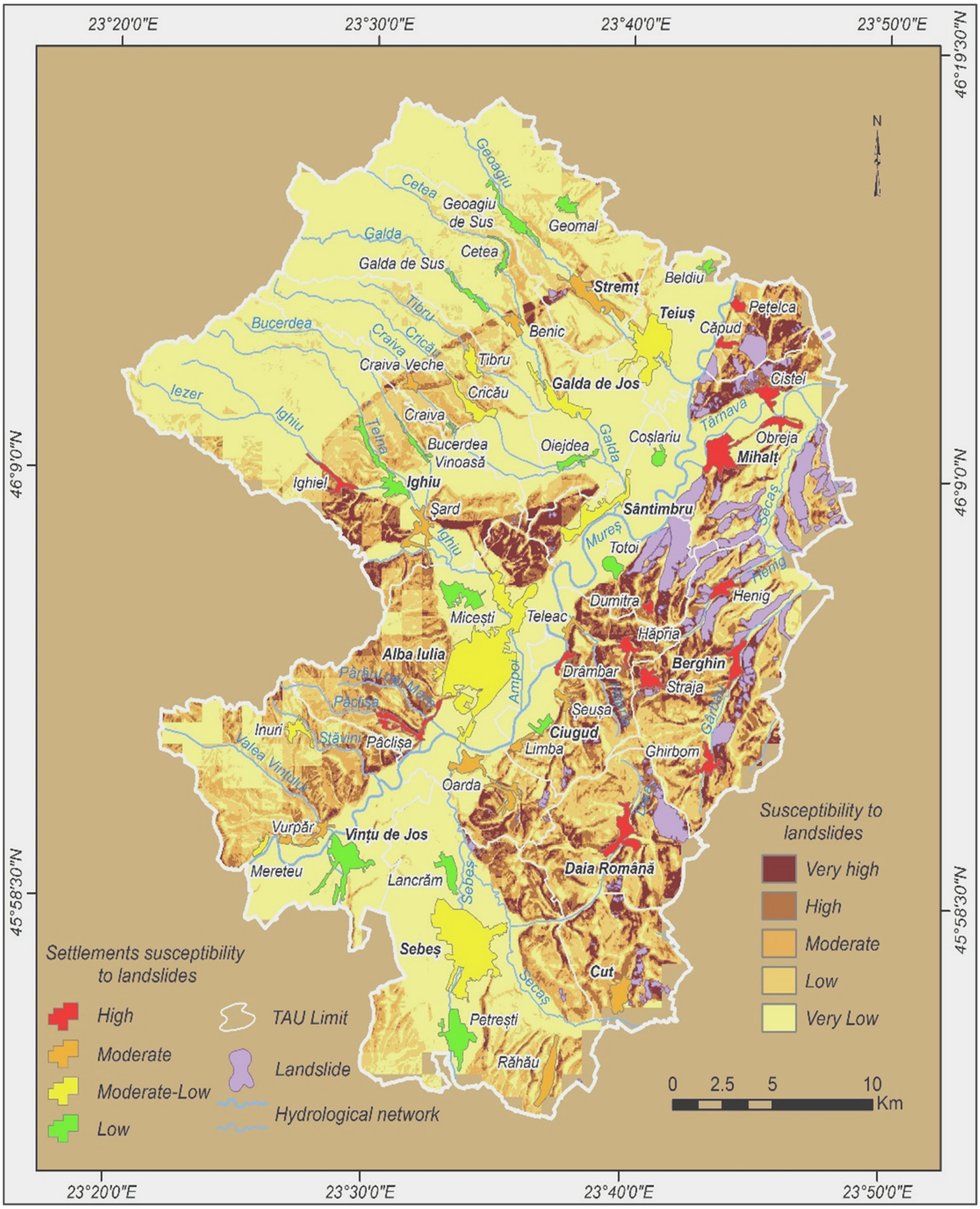


Fig. 5. Settlements susceptibility to landslides

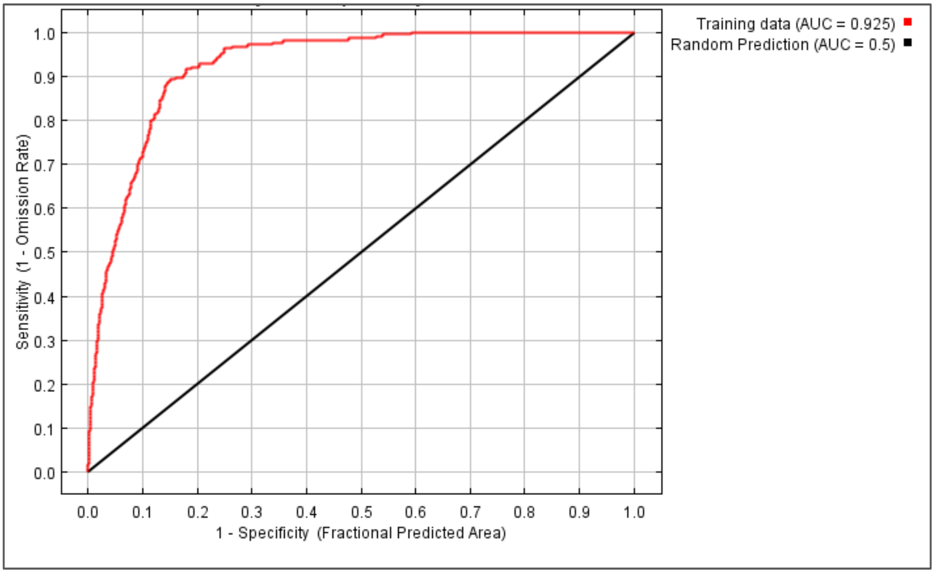


Fig. 6. ROC curve

6. CONCLUSIONS

Landslide assessment becomes important in the prediction of the areas that are most prone to landslide. Due to its devastating effects, urban and rural settlements have a higher tendency to this natural disaster, caused by the increased population.

A valid susceptibility map represents the base of the analysis of the vulnerability of the settlements. Our aim was to highlight a relational analysis between settlements situated in the Eastern and Central part of the Alba Iulia hinterland and down-slope movement.

Our purpose was realized by using GIS technology and MaxEnt software. The results were studied precisely, and validated by using the ROC method, receiving high AUC value (0,925), indicating the increased precision of our investigation. Therefore, we could generate a reliable classification about the susceptibility to landslides of the settlements.

Our model becomes useful in further analysis due to its high accuracy. Thus, based on our maps, we can conclude that the prevention of further landslides can be realized by the analysis of our results, implementing different land planning strategies, which becomes necessary because of the high percentage of susceptible areas.

REFERENCES

1. Bayes, A. (2015). *Landslide susceptibility modelling applying user-defined weighting and data-driven statistical techniques in Cox's Bazar Municipality,* Natural Hazards, pp. 1707-1737.
2. Chen, W., Chai, H., Sun, X., Wang, Q., Ding, X., Hong, H. (2016). *A GIS-based comparative study of frequency ratio, statistical index and weights-of-evidence models in landslide susceptibility mapping*, Arab J Geosci.
3. Chung, C.J.F., Fabbri, A.G. (2003). *Validation of spatial prediction models for landslide hazard mapping*, Natural Hazards, pp. 451–472.
4. Conforti, M., Robustelli, G., Muto, F., Critelli, S. (2011). *Application and validation of bivariate susceptibility assessment for the Vitraro river catchment (Calabria, south Italy)*, Natural Hazards.
5. Davis, J.D., Sims, S.M. (2013). *Physical and maximum entropy models applied to inventories of hillslope sediment sources*, J. Soils Sediments, pp. 1784–1801.
6. Davis, J.D., Blesius, L. (2015). *A Hybrid Physical and Maximum-Entropy Landslide Susceptibility Model*, Entropy.
7. Elith, J., Phillips, S., Hastie, T., Dudík, M., Chee, Y., Yates, C. (2011). *A statistical explanation of MaxEnt for ecologists*, Divers. Distrib., pp. 43–57.
8. Felicisimo A.M., Auroracuartero, Remondo J., Quiros, E. (2012). *Mapping landslide susceptibility with logistic regression, multiple adaptive regression splines, classification and regression trees, and maximum entropy methods: a comparative study,* Landslides, pp 175-189.
9. Jaynes, E.T. (1957). *Information theory and statistical mechanics*. Phys. Rev., 106, pp. 620–630.
10. Nicula, S.A., Păcurar, B.N., Constantin Veronica, Blaga Oana, Rus, I. (2015). *Development policies in Alba Iulia's influence area. An integrated approach*, Studia UBB Geographia, LX, 1, 2015.
11. Pop, G.P. (2012). *Depresiunea Transilvaniei,* Edit. Presa Universitară Clujeană, Cluj-Napoca.
12. Pradhan, B., Lee, S. (2010). *Delineation of landslide hazard areas on Penang Island, Malaysia, by using frequency ratio, logistic regression, and artificial neural network models*, Environ Earth Sci, pp. 1037–1054.
13. Philiphs, S.J., Anderson, R., Schapire, R. (2005). *Maximum entropy modeling species geographic distribution,* Ecological modelling, pp. 231-259.
14. Riley, S., Degloria, S., Elliot, R. (1999). *A terrain ruggedness index that quantifies topographic heterogeneity*, Intermountain Journal of Science, pp 23-27.
15. Roșian, Gh. (2009). *Evoluţia versanţilor afectaţi de alunecări masive de tip glimee. Studiu de caz: versantul drept al Văii Secaului Mic (sectorul Tău – Secășel)*, Geographia Napocensis, III, 1, pp. 33 – 40.
16. Roșian Gh., Horváth, Cs., Réti Kinga-Olga, Boțan, C.N., Gavrilă Ionela Georgiana (2016). *Assessing landslide vulnerability using bivariate statistical analysis and the frequency ratio model. Case study: Transylvanian Plain (Romania)*, Zeitschrift fur Geomorphologie, 60, 4, pp. 359 – 371.

17. Surdeanu, V. (1998). *Geografia terenurilor degradate*, Edit. Presa Universitară Clujeană, Cluj-Napoca, p 274
18. Swets, J.A. (1988). *Measuring the accuracy of diagnostics systems*, Science, pp. 1285-1293.
19. United Nations (2004). *Reducing Disaster Risk*, *A Challenge for Development*, United Nations Development Programme.
20. Yalcin, A. (2008). *GIS-based landslide susceptibility mapping using analytical hierarchy process and bivariate statistics in Ardesen (Turkey): Comparisons of results and confirmations*, Catena, 72, 1, pp. 1-12.

STUDIA UBB GEOGRAPHIA, LXII, 1, 2017 (p. 59-66)
(RECOMMENDED CITATION)
DOI:10.24193/subbgeogr.2017.1.04

GEOENVIRONMENTAL IMPACT STUDIES FOR HYDRO-ENERGY PROJECTS: NARYN RIVER IN KYRGYZSTAN

TATYGUL URMAMBETOVA[1,2], A. CHYMYROV[2]

ABSTRACT. – Geoenvironmental Impact Studies for Hydro-Energy Projects: Naryn River in Kyrgyzstan. Kyrgyzstan is the only country in Central Asia where water resources are fully formed in its own territory; these are its hydrological features and benefits. The country has considerable water and hydropower resources on its territory. There are over 25 thousand rivers and streams flowing from the mountains to the surrounding valleys carrying more than 50 cubic km annual water volume. The mountain rivers have a huge potential of water and hydro energy resources allowing Kyrgyzstan to reduce the traditional energy consumption. The hydro-energy projects enforces the socio-economic development of regions to meet the needs in the water, energy, flood control, etc., on the other hand they have a negative impact on the environment. Intensification of landslides, reservoir–induced seismicity, rise of groundwater level and land erosion and other environmental hazards need detailed investigations before, during construction and exploitation of hydropower stations. The geoinformation systems (GIS) and remote sensing technologies are recommended in the geoenvironmental impact studies of hydro-energy projects in the Naryn river basin. The efficiency in the use of integrated information systems created by combining the capabilities of GIS and remotely sensed data confirmed by numerous examples of successful use in practice, e.g. in the modeling of technical, natural and climate parameters to avoid disasters.

Keywords: *water resources, hydroelectric potential, hydro-power plant, Naryn River, geoenvironmental impact.*

1. INTRODUCTION

The water resources of Kyrgyzstan are one of the main national wealth which play an important role in human life, in the formation of flora and fauna, in the development of productive forces not only for the country but also a number

[1] *"Babeş-Bolyai" University, Faculty of Geography, 5-7 Clinicilor Street, Cluj-Napoca, Romania, e-mail: tatygul_urmambetova@yahoo.com.*
[2] *Kyrgyz State University of Construction, Transport and Architecture, Bishkek, Kyrgyzstan.*

of regions of Uzbekistan, Kazakhstan, Tajikistan and China. In Kyrgyzstan there are large rivers such as Naryn, Chu, Talas, Sary-Zhaz, Karadarya and others, which are flowing in the basins of Syr-Darya and Amu-Darya.

Natural resources significantly affect the socio - economic development of the state. Kyrgyzstan is a country in Central Asia, where hydropower resources are concentrated. At the present stage of economic development, sovereign Kyrgyzstan pays more attention to the study and rational use of water and hydropower resources. There is a strategy of the use of transboundary rivers, the method of pricing and rate for water in order to obtain compensatory reimbursement from the neighboring countries for the use of water resources and to solve the environmental problems (Kasymova et al., 2007).

2. DATA AND MATERIALS

Large glaciers and snow fields of mountain ranges are the source for many rivers, which are covering with a dense network the entire territory of the Kyrgyz Republic. These rivers originating in the high altitudes are characterized by a large slope, they are fast-flowing and have significant energy capabilities. Currently all over the world and also in the Kyrgyz Republic there is an interest in obtaining energy from renewable energy sources, which are the potential energy of the sun, water and biomass. The use of power plants that convert the energy of these sources in any other form of energy is aimed primarily in improving the supply of relatively small objects, located in areas remote from centralized electric and thermal networks, oil and gas pipelines.

On the territory of the Kyrgyz Republic there are dozens of large and hundreds of small rivers and canals which have thousands of mountain streams as tributaries. The estimated capacity of the hydropower potential of small water courses is 1.6 million kW. The potential hydropower of small watercourses is expedient to direct to the small and micro hydro power plants, where the construction of centralized power lines is technically and economically not profitable.

The variations in amplitude of the working volume and energy consumption from year to year caused by the water discharge of the Naryn River results in the limited electricity production of the Naryn cascade power plants during the winter season. The highest energy consumption is between November and March. However, in this period the electricity generated by the Toktogul HPP (hydroelectric power plant) cascade is limited due to irrigation obligations of Kyrgyzstan to neighboring countries. Therefore, the electricity supply in the whole country and particularly in the Issyk-Kul region is insufficient.

The rivers and streams of the Kyrgyz Republic are fed by melting water and the seasonal melt of snow and glaciers. The rainwater is negligible in the runoff of the rivers. Ground waters have a crucial importance for feeding the rivers during the cold season. The flood hydrograph data (water flow chart) on the rivers of the Kyrgyz Republic has a pectinate view. Two peaks are noticeable – one in spring and another in summer.

3. RESULTS AND DISCUSSIONS

The studies of the Institute of Water Problems and Hydropower of the National Academy of Sciences of the Kyrgyz Republic have shown that the hydroelectric potential of small rivers of the Kyrgyz Republic in all its areas allows the construction of 92 new small hydropower plants with a total capacity about 178 MW and an annual output up to 1.0 bln. KWh. In addition it would be possible to restore the pre-existing 39 small hydropower plants with a total capacity of 22 MW and an annual output up to 100 mln. KWh. In the longer perspective, 7 HPP can be built on the irrigation reservoirs with an installed capacity of 75 MW and an average annual power generation about 220 million KWh. This would significantly reduce the fuel supply dependence of remote and rural areas.

The following table shows the hydroelectric potential of small rivers of the Kyrgyz Republic (by regions) according to the research of the "Energy" KSTC (Kyrgyz scientific and technical center):

Table 1. The hydroelectric potential of small rivers of the Kyrgyz Republic (by regions)

Regions	Potential energy capacity, thousand kilowatt	Potential energy, million kilowatt-hour	Technically suitable for development potential, million kilowatt-hour
Chuy	640	5545	500
Issyk-Kul	2005	17390	1700
Talas	354	3104	320
Naryn	2032	1778	1600
Osh	2641	2320	2300
Jalal-Abad	1728	15045	1600
Total million kilowatt-hour	9400	82072	8020

Micro hydroelectric plants with 5 kW will provide electricity to the small farms which are remote from the settlements and centralized electric networks. The energy potential of micro and small hydroelectric plants depending on the magnitude of the water flow should be determined for the minimum flow in the cold season, as well as the nominal (on the required power) flow of the warm period of the year (Lepkin et al., 2007).

The biggest Kyrgyz hydroelectric plant is Toktogul hydroelectric station, which was set in operation in 1975. The lower Naryn cascade of hydropower plants have a total capacity of 2780 MW including Toktogul reservoir (project capacity 19.5 billion cubic meters) of long-term operation and Kurpsai, Tashkumyr, Shamaldysai and Uchkurgan reservoirs with seasonal and daily regulation which also provide coverage of variable schedules load profiles of neighboring states and frequency regulation in the united energy systems of Central Asian (CA) region.

The optimal operation of the united energy systems of Central Asian region suggests providing mutual deliveries of electricity with the maximum production on the hydroelectric plant cascade during the vegetation season under the complex use of the hydropower resources of the Naryn-Syrdarya basin and the maximum production of thermal power plants in the autumn-winter period. For the region, the most important problem is the integrated use of the Toktogul waterworks in compliance with the interests of the lower countries - Kazakhstan and Uzbekistan and providing sanitary water releases to the Aral Sea basin (Kasymova et al., 2007).

The Kyrgyz energy system is part of the united energy systems of CA and operates in parallel mode with the energy systems of Uzbekistan, Kazakhstan and Tajikistan. The main plants are located in the South while 65% of the consumers live in the North of the country. The two regions are connected by a power line with the capacity 500 kW from the Toktogul HPP cascade to the substation of the Karabalta city area. The consumers of Kyrgyzstan experience an electricity deficit during autumn and winter and excess during the vegetation seasons. The electricity generated in the cascade of Toktogul hydroelectric power station enters the energy system of Uzbekistan and then through the Zhambyl region of Kazakhstan under the scheme of substitution to the north of Kyrgyzstan. In this way the power system of the Kyrgyz Republic works in parallel with the energy systems of Uzbekistan and Kazakhstan and is entirely dependent on neighboring countries for electricity transmission for its own consumption. The reason is the lack of connecting 500-220-110 kW networks (Kasymova et al., 2011).

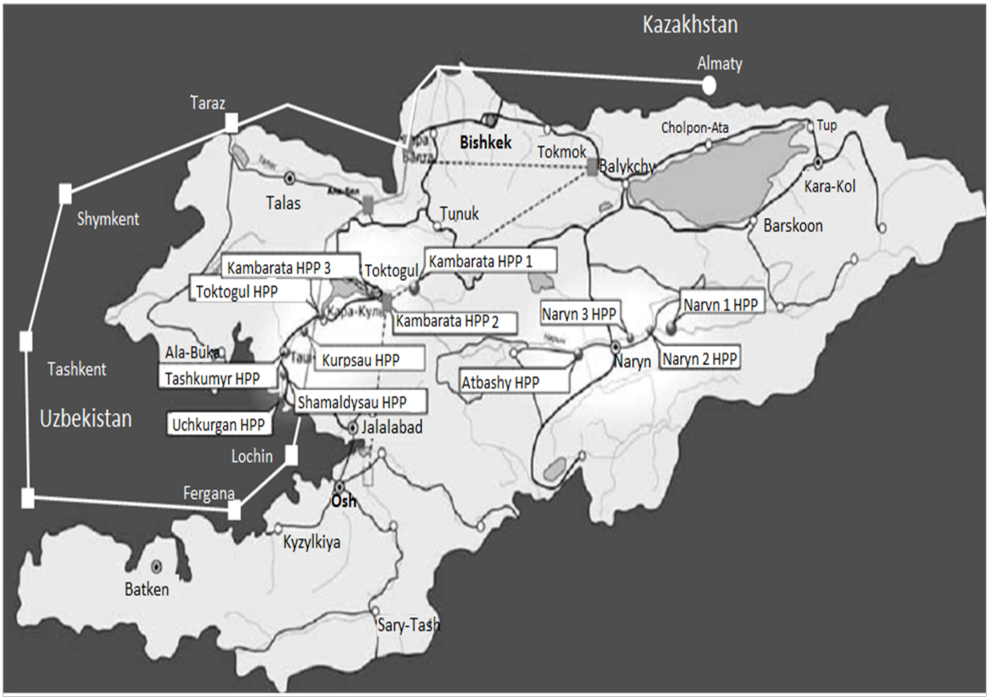


Fig. 1. The location scheme of the existing and perspective hydroelectric plants of the Kyrgyz Republic (source: Eurasian Economic Integration №3 (12))

The cyclic aridity in the Naryn river basin has resulted in a reduction of electricity generation of Toktogul HPP cascade and the particularly severe winter of 2007-2008 contributed to the multiple growths of loads by consumers, which has led to emergency blackouts due to wear and tear of equipment and electrical networks. The irregular distribution of energy facilities on the territory of the country is the reason for the deficit of capacity and electricity in the North of the country where many of the energy consumers are located. The Kyrgyz Republic takes second place in Central Asia in terms of the hydroelectric potential of river basins which are estimated to the amount of 142 billion KWh of electricity generation potential per year. Currently the level of use of all the potential water resources of Kyrgyzstan varies from 8 to 10%, depending on the water availability of the year. The Naryn River basin has the highest level of development, reaching almost 50% of production and capacity. The lower Naryn cascade of HPP consists of five hydroelectric stations: Toktogul (1200 MW), Kurpsai (800 MW), Tashkumyr (450 MW), Shamaldysai (240 MW) and Uchkurgan (180 MW). In addition it also includes very important facilities for CA irrigation (e.g. Toktogul reservoir). In the upper stream of Naryn River there is At-Bashy HPP (the installed capacity is 40 MW) while eight small hydroelectric plants with a total installed capacity 29.78 MW are located in the Chu River basin.

The hydraulic structures needed for the socio-economic development of the region to meet the needs of water, energy, flood control, have on the other hand a negative impact on the environment. The relationship between natural and social factors needs an integrated consideration of environmental issues. The construction and exploitation of the hydraulic structures could significantly affect the natural conditions, changes the ecosystem, the fauna and flora of the Naryn River. For the Naryn River with its high hydropower potential, the preservation of natural ecosystems and the biota of the river has a practical significance.

To detect the changes in the environment, predict and estimate the current situation and the future rational use of natural resources, the use of remotely sensed data and GIS (geoinformation systems) is required. The topical application of remote sensing techniques is the high information content of satellite images obtained at different temporal, spatial, spectral and radiometric resolutions. To represent an entire scene of the actual situation of the river valley is difficult. The cartographic materials used on paper nowadays are rapidly becoming outdated because the situation along the river may change several times during the year. The maps and cartographic materials are the most recognized sources of various data about the study area; they provide spatially defined information about the object. The efficiency of using remotely sensed and GIS data at the visualization and monitoring of the spatial - temporal changes and predicting the condition of the environment is confirmed by numerous successful applications.

With the use of satellite images, GIS and GPS (global positioning systems) data, the following geo-ecological problems may be solved: the collection and accumulation of data about the study area in the form of digital topographic maps and plans, the monitoring of the changes in the shape of reservoirs and water bodies shores, the updating of maps, the monitoring of the infrastructure, the monitoring of the changes in the environment, the prediction of floods on the territory and the development of flood prevention activities, the assessment of damages caused by natural disasters (e.g. floods) and the avoidance of accidents on the hydraulic structures which allow us to use water resources efficiently with a minimal damage to the environment. The geoinformation systems solving issues of multi-operational data from various sources are an effective means for the monitoring and estimation of emergency consequences (Shishkin et al., 2014). In parallel with the construction and exploitation of the hydraulic structures, one must consider that the territory of the Kyrgyz Republic is characterized by a mountainous terrain which continues to form at present time in the interaction of internal and external geological and geophysical processes. These processes are the cause for more than 20 types of natural hazards spread across the country. Their evolution and activation leads to emergency situations. Most often the occurrence of emergencies and disasters are due to natural processes, such as earthquakes (Kyrgyzstan territory belongs to the 8-9 point zone), landslides (about 7.5% of the country is exposed to landslide processes, a danger to more than 600 settlements), mudflows and floods (approximately 95% of all the settlements are exposed to potential danger from landslides and floods), avalanches (53% of the country is exposed to the danger of avalanche).

4. CONCLUSIONS

The application of remote sensing data and GIS technologies using the appropriate methodologies and software packages can lead to the creation of digital maps used for the prediction of natural processes in the area of the hydraulic structures, which will help to protect the environment and optimize the engineering protection against emergencies. This would allow the provision of expeditious, reliable and full data about the location of potentially dangerous situations on the ground. The cartographic way of presenting information shows the nature and extent of the possible danger by using a spatial dimension of the emergency.

REFERENCES

1. Bulgakova, T. Ju., VovkI, G. (2014). *The system-oriented approach to the analysis of spatial-temporal condition oftechnogenic systems*. Interexpo Geo-Siberia. Number 1 / Volume 1.
2. Jasinski, V.A., Mironenkov A.P., Sarsembekov, T.T. (2011). *A modern condition and prospects of development a small hydropower in the CIS countries*, Industrial Overview, №14. Eurasian Development Bank. Almaty, p. 36.
3. Kasymova V.M., Arkhangelskaja A.V. (2011). *Energy Security of Kyrgyzstan and the development of intergovernmental energy connections in the Eurasian Economic Community (Central Asia).* Eurasian Economic Integration, №3 (12), p. 46.
4. Kasymova, V.M., Baetov, B. (2007). *Energy of Kyrgyzstan: condition of the sector and prospects for intergovernmental cooperation*, Central Asia and the Caucasus, № 6 (54), p. 116-127.

5. Kiselevskaja, K.E. (2009). *Application of the method of remote sensing for environmental monitoring,* Mountain Informational and Analytical Bulletin. №1, p. 188-190.
6. Lipkin, V.I., Bogombaev, E.S. (2007). *Micro hydro power plants: Manual usage*, Bishkek, 30 p.
7. Mamatkanov, D.M., Bazhanova, L.V., Romanovsky, V.V. (2006). *Water Resources of Kyrgyzstan at the present stage*, Ilim, Bishkek, 276 p.
8. Rahimov, K.R. (2010). *Kyrgyzstan Power lines, particular qualities, methods of calculation and management*, KSTU named after I. Razzakov, IC "Teknik", Bishkek, 151 p.
9. Shakhramanyan, M.A. et al. (2003). *Application of GIS technologies for flood hazard predicting*. Civil Security Technologies. № 1-2, p. 62-68.
10. Shishkin, I.N., Skugarev, A.A. (2014). *Application of geoinformation technologies for monitoring and evaluation the consequences of emergencies*, Reports of TUSUR, № 2 (32), p. 276-280.
11. *Program of complex monitoring and forecasting of natural hazard processes with the application of GIS and remote sensing in the 2015-2017 years*, Erkin Too, May 5, 2015, № 40.
12. *http://foraenergy.ru/*
13. *Transparency initiative of the fuel and energy complex of the Kyrgyz Republic*. *http://www.energoforum.kg/*

STUDIA UBB GEOGRAPHIA, LXII, 1, 2017 (p. 67-76)
(RECOMMENDED CITATION)
DOI:10.24193/subbgeogr.2017.1.05

GENDER AND AGE GROUP STRUCTURES IN MUREŞ COUNTY, AT THE 2011 CENSUS

G. B. TOFAN[1], A. NIŢĂ[2], B. N. PĂCURAR[3]

ABSTRACT. – Gender and Age Group Structures in Mureş County, at the 2011 Census. The importance of possessing knowledge regarding the above mentioned component stems from territorial demographic and social-economic planning. Thusly, we emphasized the *population gender structure*, starting with *both genders* (BG), followed by *male* (M) and *female* (F) populations. We then proceeded to examine *age groups*, according to the logical succession comprising *young people* (*0-19 years of age*), *adults* (*20-59 years*), and *seniors* (*≥ 60 years*). The demographic pyramid of Mureş County reveals the same aging process recorded at national level, with a *regressive population*, where young people register increasingly lower values, while elderly people are more numerous. Age group structure is also influenced by other exogenous factors, such as *migration* (internal and external). The young urban population of Mureș County is lower (19.89%) than in rural areas (24.93%), while the latter areas have an older population (23%) compared to urban areas (21.72%). The adult population dominates all of the county's administrative-territorial units, the highest values having been recorded in urban settlements (58.39%), where the county seat, the city of Târgu Mureș, reigns supreme (60.08%), while rural areas registered an average of 52.09%, with higher values (above 60%) only in Corunca and Sângeorgiu de Mureș.

Keywords: *population, male, female, age groups, 2011 Census*.

[1] *„Vasile Goldiş" Western University of Arad, Faculty of Economic Sciences, Engineering and Informatics, Departament of Engineering and Informatics, Baia Mare Branch, 5 Culturii Street, Romania, e-mail: bogdan.tofan@uvvg.ro*

[2] *„Babeş-Bolyai" University, Faculty of Geography, Gheorgheni Branch, Csiki Garden, Romania, e-mail: nitaadrian@hotmail.com*

[3] *„Babeş-Bolyai" University Cluj-Napoca, Faculty of Geography, Centre for Research on Settlements and Urbanism; Cluj County Council, Urbanism and Territorial Planning Department, Cluj-Napoca, Romania, e-mail: pacurarbogdan@ymail.com*

1. INTRODUCTION

The authors of the study are at their third analysis of the gender and age structure of the population registered at the 2011 Census. The first study involved the County of Harghita, while the second Covasna County, both having been published in the Annals of Oradea University, Geography Series (XXVI, no. 1&2/2016) (see references).

We employed data from the Population and Household Census of 2011, the National Institute of Statistics enabling the possibility to freely access the necessary geodemographic indicators. We must also point out that *the Mureș County Statistical Department* (*http://www.mures.insse.ro*) is among the few in Romania which offers online data at microscalar level (component settlements and villages).

The second stage of the research involved the data analysis, processing and interpretation, in the form of tables, graphs and maps, thus insuring a proper dissemination of the results. We also used several scientific papers and studies that tackled this component (Pop et al., 1973; Surd, 2001; Pop, 2002; Pop et al., 2015; Tofan, 2014 b), focused either on the entire county (Șoneriu & Mac, 1973) or on certain of its areas (Tofan, 2014 a), as well as the methodological guidebooks written by Vert in 1995 and 2001.

2. THE GENDER AND AGE STRUCTURE OF THE POPULATION OF MUREŞ COUNTY

At the census held on 20th October 2011, the County of Mureș registered 550,846 inhabitants, 48.82% (268,941 people) being male, while 51.18% (281,905 people) female.

2.1. Both genders

a) Young people (*0-19 years*), with a county percentage of 22.39% (123,353 inhabitants out of 550,846), registered values around the above mentioned average, *21-23%,* in two urban areas (Târnăveni and Sovata) and in 21 communes (Adămuş, Aţintiş, Bogata, Breaza, Chețani, Corunca, Cuci, Fântânele, Gălești, Gănești, Hodoșa, Ibănești, Lunca, Măgherani, Pănet, Păsăreni, Răstoliţa, Ruşii Munţi, Sâncraiu de Mureş, Sânpetru de Câmpie and Vătava).

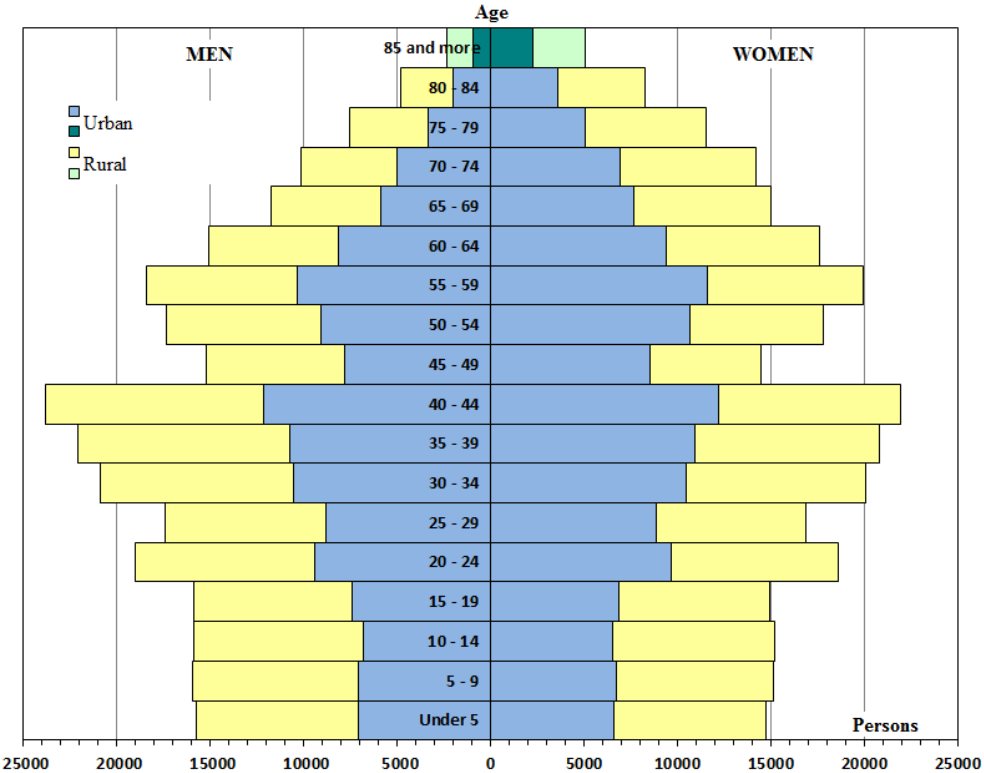


Fig. 1. The age pyramid of Mureş County, 2011

Values below *21%* were recorded in 15 administrative-territorial units, the commune of Băla having the lowest percentage (14.81%). Higher values, *23-25%,* were found in 25 settlements (3 urban and 22 rural), while the highest, *above 25%*, in the remaining 39 areas, such as Ungheni (25.79%), Apold (31.71%), Band (31.01%, Nadeş (31.12%), Ogra (31.13%), Petelea (31.64%), Vânători (32.25%) and Viişoara (33.76%).

b) Adults (*20-59 years*) registered an average of 55.25% (304,368 people) at county level. Values close to this number, *54-56%*, were found in 15 administrative-territorial units (Târnăveni, Sângeorgiu de Pădure, Ungheni, Apold, Batoş, Brâncoveneşti, Ernei, Găneşti, Gurghiu, Hodac, Ibăneşti, Livezeni, Lunca Bradului, Solovăstru, and Stânceni), while the next 13 units comprising the *above 56% category*, where the highest value was found in Corunca (61.04%). The lower category, below *54%*, encompass 74 areas, the lowest having been found in Băla (38.23%) and Bichiş (37.89%).

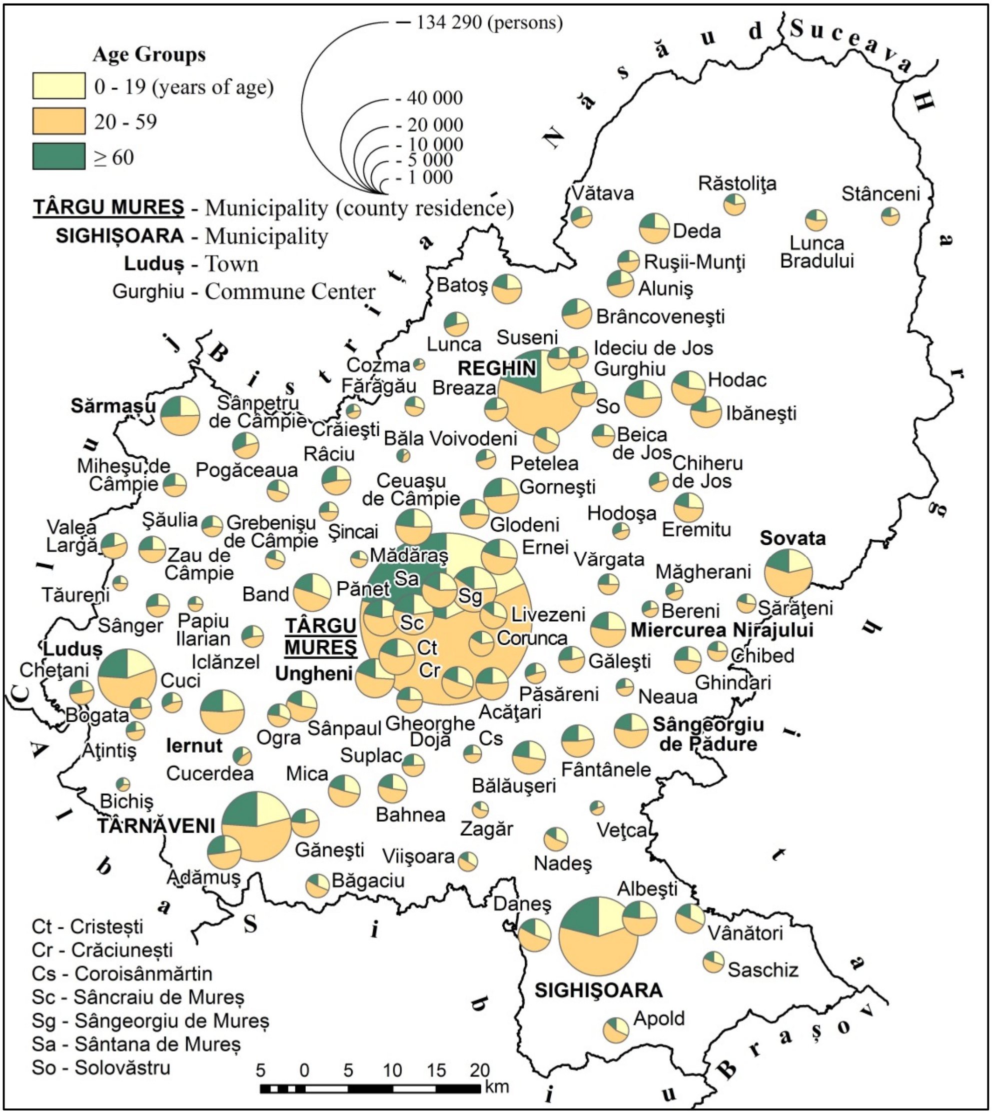


Fig. 2. Age group structure in Mureş County, LAU 2 level, at the 2011 Census

c) Elderly people (*over 60 years of age*) registered 22.35% at county level (123,125 people). The elderly population can be classified as follows: around the average, *21-23%*, values found in 17 settlements (Târgu Mureş, Sighişoara, Miercurea Nirajului, Sângeorgiu de Pădure, Albeşti, Bahnea, Bălăuşeri, Ceuaşu de

Câmpie, Chibed, Grebenişu de Câmpie, Gurghiu, Ibăneşti, Mădăraş, Pănet, Pogăceaua, Sâncraiu de Mureş, and Solovăstru); the *23-25% category* including 13 units; above *25%* in 44 areas, with its highest values of 46.96% found in Băla, and the category of *below 21%* with the remaining 28 units (Apold having the lowest, 13.00%).

2.2. The male population of Mureş County

It ammounted to 268,941 people (48.82%) and it also can be divided into three main age groups: young people, numbering 63,418 or 23.58% (0-19 years); adults, with a number of 153,968 or 57.25% (20-59 years), and elderly with 51,555 people or a percentage of 19.17%. In terms of the entire 102 administrative-territorial units that comprise the county, the percentages of males were highly varied.

a) The young people group (*0-19 years*), with an average value of 23.58%, registered percentages above the average, or *22-24%,* in three urban areas (Târnăveni, Sângeorgiu de Pădure, and Sovata) and 18 communes (Acăţari, Adămuş, Aţintiş, Bogata, Breaza, Chiheru de Jos, Cozma, Cuci, Fântânele, Găleşti, Gorneşti, Lunca, Măgherani, Pănet, Păsăreni, Sâncraiu de Mureş, Suplac, and Vătava). Values above *24%* characterised 63 administrative-territorial units, such as the communes of Petelea (33.33%) and Viişoara (33.84%). Lower values, below *22%*, were found in the remaining 18 cities and communes of Mureş County, the lowest being recorded in Băla (15.84%).

b) The adults age group (*20-59 years*) registered an average of 57.25% (153,968 inhabitants). Percentages around the average or *56-58%* were recorded in four urban areas and 22 rural areas. Most units comprised the *below 56% category* (61 to be more exact, Băla, with 42.86%, having the lowest value), while the above *58%* only included 15 settlements (Corunca, 61.87%, had the highest percentage of males).

c) The elderly (*above 60*) reached an average of 19.17% (51,555 inhabitants out of a total of 268,941 males). 22 administrative-territorial units found themselves around the mentioned value, between *18-20%* (Târgu Mureş, Sighişoara, Miercurea Nirajului, Sângeorgiu de Pădure, Bălăuşeri, Beica de Jos, Breaza, Ceuaşu de Câmpie, Fântânele, Găneşti, Ghindari, Pogăceaua, Sâncraiu de Mureş, Şincai, Solovăstru and Suseni).

Values below *18%* were recorded in 32 units, the commune of Apold having the lowest percentage (11.68%), while values above *20%* were repoertd in the remaining 48 units, Băla again registering the lowest numbers (41.30%).

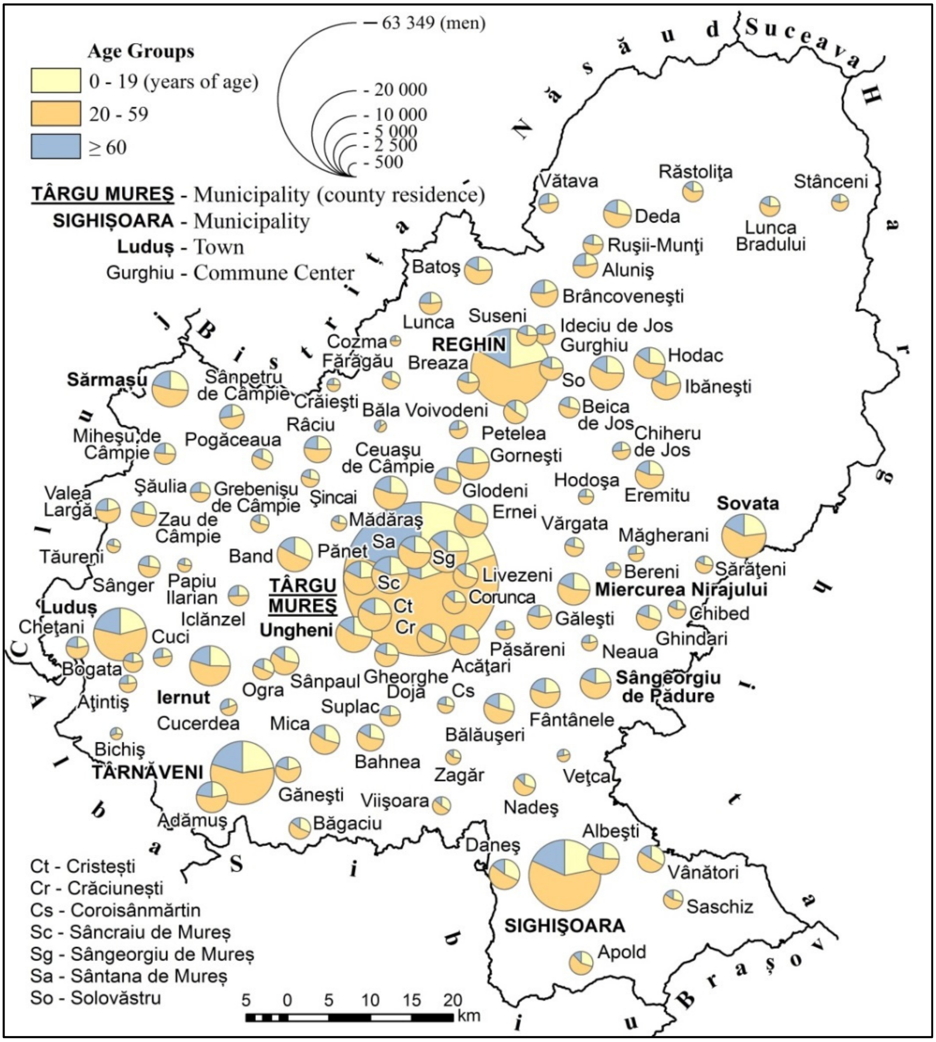


Fig. 3. The age group structure of the male population of Mureș County, LAU 2 level, at the 2011 Census

2.3. The female population of Mureș County

The female population of Mureș County numbered 281,905 individuals (51.18%) of the county's population. Young females had a percentage of 21.26% (59,935 individuals), the adult 53.35% (150,400 individuals), while the elderly 25.39% (71,570).

a) The young category (*0-19 years*), with an average percentage of 21.26%, was classified as follows: the *20-22%* category comprised 22 administrative-territorial units; above *22%* category included 64 areas (the highest value in Apold, 33.75%); the below *20%* category in the remaining 6 urban areas and 10 communes (Cucerdea, 12.93%, had the lowest representation of young females).

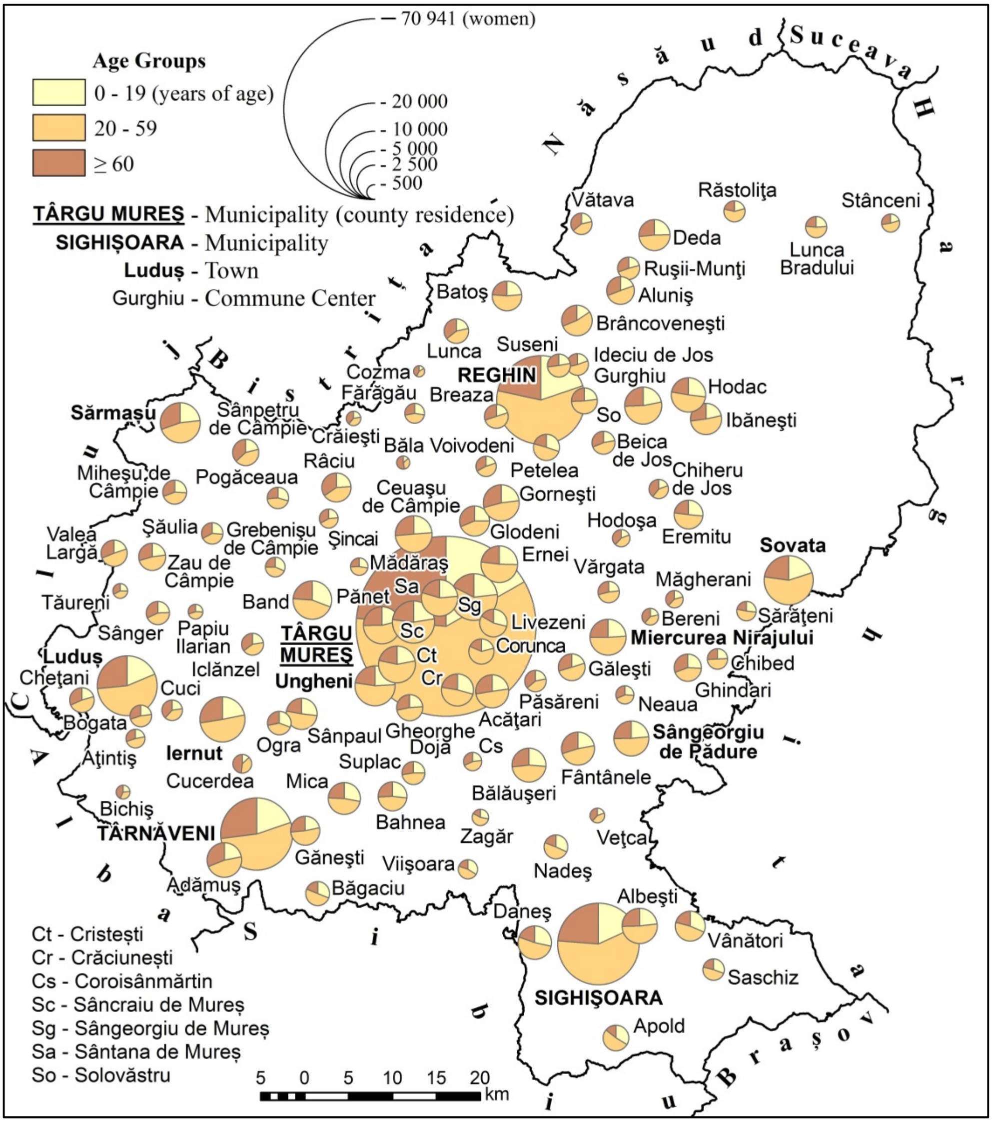


Fig. 4. The age group structure of the female population of Mureș County, LAU 2 level, at the 2011 Census

b) The adult category (20-59 years), with 150,400 individuals (53.35% of the total female population of the county) was distributed in the following manner: values of *52-54%* in eight settlements (Târnăveni, Ungheni, Batoş, Brâncoveneşti, Daneş, Gurghiu, Lunca Bradului, and Pănet), above *54%* with 13 areas (Târgu Mureş, Reghin, Sighişoara, Luduş, Sovata, Corunca (the highest value, 60.20%), Cristeşti, Livezeni, Răstoliţa, Sâncraiu de Mureş, Sângeorgiu de Mureş, Sântana de Mureş and Zagăr; values below *52%* in most administrative-territorial units (81), Băla registering the lowest percentage, 33.42%.

c) The elderly female category (over 60 years), with an average of 25.39% (71,570 individuals out of a total of 281,905 women) had the following structure: 11 areas recorded values around the average, *24-26%*, - Miercurea Nirajului, Sângeorgiu de Pădure, Albeşti, Bahnea, Chibed, Grebenişu de Câmpie, Gurghiu, Mădăraş, Mica, Pănet and Solovăstru. Values below *24%* were found in 30 units (the commune of Apold having the lowest value, 14.34%), while values above *26%* were registered in 61 towns and communes, Băla having the highest rate of elderly women in the county (52.83%).

3. CONCLUSIONS

At county level, out of a total population of 550,846 inhabitants, females formed the majority (a ratio of 104 women / 100 men). We encountered the following situation after analysing the major age groups of Mureş County: 55.25% *adults* (304,368 people out of 550,846 inhabiting the county), 22.35% *elderly* (123,125) and 22.39% *young people*.

Table 1. The gender and age group structure of Mureş County at the 2011 Census (Data source: 2011 Census)

Mureş County	Gender	Total stable population	Age groups					
			0-19	%	20-59	%	≥ 60	%
TOTAL	**BG**	**550846**	**123353**	***22.39***	**304368**	***55.25***	**123125**	***22.35***
	M	**268941**	**63418**	***23.58***	**153968**	***57.25***	**51555**	***19.17***
	F	**281905**	**59935**	***21.26***	**150400**	***53.35***	**71570**	***25.39***
Urban	**BG**	276773	55039	*19.89*	161613	*58.39*	60121	*21.72*
	M	132494	28360	*21.40*	78801	*59.48*	25333	*19.12*
	F	144279	26679	*18.49*	82812	*57.40*	34788	*24.11*
Rural	**BG**	274073	68314	*24.93*	142755	*52.09*	63004	*22.99*
	M	136447	35058	*25.69*	75167	*55.09*	26222	*19.22*
	F	137626	33256	*24.16*	67588	*49.11*	36782	*26.73*

BG = both genders, M = male, F = female.

Young people (22.39%) varied in terms of percentages between 14.81% (Băla) and 33.76% (Viişoara), values above 30% having been found only in Crăciuneşti, Daneş, Pogăceaua, Band, Băgaciu, Apold, Nadeş, Ogra and Petelea.

Adults were the most abundant (55.25%), values above 60% having been found in the county residence city of Târgu-Mureș (60.08%) and in two adjacent communes (Sângeorgiu de Mureș, 60.38%, and Corunca, 61.04%), while the lowest values were recorded in two rural settlements with populations below 1,000 inhabitants (Bichiş, 37.89% and Băla, 38.23%).

Older people averaged 22.35%, while the highest percentage of elderly (46.96%) was registered in Băla, and the lowest in Apold, a rural community where the Gypsy population exceeds 20%.

In urban areas, values below the 21.72% average were recorded in half of the county's towns (Ungheni, Reghin, Sovata, Sighişoara and Târgu-Mureş), areas where adults were numerous. The town of Sărmaşu (25.80%) was at the opposite side, recording the highest value.

REFERENCES

1. Pop Gr., Galoş M., Ivan Ana, Moş Tr. (1973). *Structura pe grupe de vârstă a populaţiei judeţului Bihor*, Lucrări Ştiinţifice, Seria Geografie, Oradea.
2. Pop P. Gr. (2002). *Structura pe sexe a populaţiei Regiunii de Nord-Vest a României*, Studia UBB Geographia, 2, Cluj-Napoca.
3. Pop P. Gr., Zotic V., Alexandru Diana Elena (2015). *The Romanian Population by Gender and Age Groups in 2011*, Studia UBB Geographia, LX, 1, Cluj-Napoca.
4. Surd, V. (2001). *Geodemografie*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
5. Şoneriu I., Mac I. (1973). *Judeţul Mureș*, Edit. Academiei R.S.R, Bucuresti.
6. Tofan G.B. (2014 a). *Defileul Mureşului. Studiu de Geografie Umană*, Edit. Presa Universitară Clujeană, Cluj-Napoca.
7. Tofan, G.B. (2014 b). *The Ethnic and Confessional Structure of Mureș County in 2011*, Analele Univ. din Oradea, Seria Geografie, Tom XXIV, Nr. 1, Edit. Universității din Oradea.
8. Tofan, G.B., Niţă, A., Păcurar, B.N. (2016). *Gender and Age Group Structure in Harghita County, at the 2011 Census*, Analele Univ. din Oradea, Seria Geografie, Tom XXVI, Nr. 1, Edit. Universității din Oradea, Oradea.
9. Tofan, G.B., Niţă, A., Păcurar, B.N. (2016). *Gender and Age Group Structure in Covasna County, at the 2011 Census*, Analele Univ. din Oradea, Seria Geografie, Tom XXVI, Nr. 2, Edit. Universității din Oradea, Oradea.
10. Vert, C. (1995). *Analiza geodemografică. Manual practic*, Universitatea de Vest din Timişoara, Facultatea de Chimie-Biologie-Geografie, Catedra de Geografie, Timişoara.
11. Vert, C. (2001). *Geografia populaţiei. Teorie şi metodologie*, Edit. Mirton, Timişoara.

12. *** (1984). *Geografia României, II, Geografia Umană și Economică*, Edit. Academiei R. S. România, Bucuresti.
13. *** (2012). *Reactualizarea Planului de amenajare a teritoriului judeţean, judeţul Mureş, partea I, Analiza situaţiei existente, vol. IV, Structura socio-demografică, Populaţia şi potenţialul demografic*, proiectant: Universitatea „Babeş-Bolyai" Cluj-Napoca, Facultatea de Geografie, Cluj-Napoca.
14. *http://www.recensamantromania.ro/rezultate-2, consulted at 01 April 2016*.
15. *http://www.mures.insse.ro/main.php, consulted at 01 April 2016.*

STUDIA UBB GEOGRAPHIA, LXII, 1, 2017 (p. 77-85)
(RECOMMENDED CITATION)
DOI:10.24193/subbgeogr.2017.1.06

URBANIZATION PROCESSES IN THE KYRGYZ REPUBLIC. CASE STUDY: THE CITY OF BISHKEK

M. DYLDAEV[1]

ABSTRACT. – Urbanization Processes in the Kyrgyz Republic. Case Study: the City of Bishkek. In the Kyrgyz Republic the urban population is 34% and on its territory there are 31 cities at different levels. About 60% of the urban population lives in two cities - Bishkek (the capital) and Osh. At present, the urban population is about 1,987,000 inhabitants. The main specificity is that urbanization processes develop in a mountain territorial location. Urban areas are mostly located in valleys and low mountain areas, with the exception of some urban systems, which are located in the middle part. An important task at the moment is to find a solution for the socio-economic problems of small towns. In this regard, there is need for an integrated treatment of the inevitable new residential policy - shaping Bishkek agglomeration with surrounding satellite cities.

Keywords: *urbanization, sustainable development, agglomeration, unplanned urbanization, cities satellites plan*

1. INTRODUCTION

The territory of the Kyrgyz Republic stretches from west to east for 900 km, from north to south for 410 km, and is located approximately between 39 ° and 43 ° North latitude. The area of the territory of Kyrgyzstan is 199,900 square km. It borders to the North with the Republic of Kazakhstan, to the West - with Uzbekistan, in the South-West - with the Republic of Tajikistan, in the South-East - with China.

In the Kyrgyz Republic the process of urbanization in the main proceeded after industrialization. In 1941 and 1942, about 30 factories were moved to Kyrgyzstan and partially reallocated to military production. They were mainly located in the Chui region and Bishkek. In those same years, the first large irrigation canals were built, which led to an increase in agricultural production (*Urbanization in Central Asia*, 2013).

[1] *Bishkek Humanities University, Kyrgyz Republic, e-mail: mdyldaev@gmail.ru*

According to local experts, an urbanization policy was conducted in the post-Soviet period in Kyrgyzstan. Key government's efforts were aimed against the economic crisis in which the country found itself after the break of economic ties with the former Soviet Union economic complex.

The development of the cities as elements of the settlement system allows to more clearly identify their problems and to find solutions. Accordingly, small and medium-sized cities of the country can be divided into the following groups: centers of the mining industry; agribusiness, in the case of the administrative centers of agricultural areas; cities with processing profile enterprises; transportation centers and recreation centers.

From a historical evolution of the forms of settlement to replace the traditional types of populated areas, developing relatively autonomously, comes a new "group" formed of highly concentrated settlement resulting from the close placement of the settlements and the formation of intense relationships between them. These are the urban agglomerations (CA) - intensively developing worldwide clusters of settlements, consisting of dozens, and sometimes hundreds of localities, including rural settlements, even closely related to one another. There is no unified terminology to refer to such a concentration of the population. Along with the term "agglomeration", the terms "a constellation of cities", "areas of the big cities," "local settlement system", "group settlement system" are used.

In the Kyrgyz Republic, the category of cities of regional importance includes settlements that are administrative, economic and cultural centers, with industrial companies, utilities and housing, an extensive network of educational, cultural, educational, medical and shopping facilities, with a population of not less than 20,000 people.

The category of cities of local importance includes administrative, economic and cultural centers, which have a production and social infrastructure, an extensive network of educational, cultural, educational, medical and shopping facilities, with a population of not less than 10,000 people.

The category of urban settlements can be classified as settlements which are located on the territory of economically important facilities (industrial enterprises, construction sites, railway stations, etc.), or in areas that have a therapeutic value if they have reached a certain level of improvement, with a population of more than 2,000 inhabitants.

In exceptional cases, the category of urban settlements may comprise settlements with smaller population, but they need to be administrative, economic and cultural centers, and to have a certain perspective of further economic development and population growth. (Law no. 65/ April 2008).

However, small and medium-sized cities are part of the territorial structure of the economy. Therefore, they must find a place in the territorial development strategy. In particular, public events are important, providing support for small and medium-sized cities by attracting additional funds, which will allow to remove the urban socio-economic tensions.

The priority of further improving the system of settlements should be the transition from the extensive to the intensive phase of urbanization. In this reference frame, the settlement system will develop towards large metropolitan areas in each of the regions of the country and settlements that form the area will gravitate towards them, reaching higher urban living standards.

Table 1. The distribution of urban population in the Kyrgyz Republic by category (1989-2012)

Category of the city	Amount				Population (thousand people)			
	1989	1999	2009	2012	1989	1999	2009	2012
Small (up to 50,000)	15	15	20	19	366.4	379.7	444.7	478.9
Medium (50-100,000)	4	3	3	4	259.2	194.1	205.6	274.0
Large (>100,000) thousand and higher)	2	2	2	2	821.4	958.8	1,054.7	1,130.2
Total	**21**	**20**	**25**	**25**	**1,447.0**	**1,532.7**	**1,705.1**	**1,883.2**

By their nature, urban areas in the Kyrgyz Republic have a number of specificities that are characteristic of the mountainous areas of the world: a) urban settlements and settlements in general formed in a mountainous terrain (amplitude height above sea level is 450-7439 m), the uppermost settlement and some villages are situated at an altitude of more 3000m.; b) Most of the settlements are located in the valley of the foothills, and have the character of uneven distribution (almost 80% of the settlements concentrate in 15% of the country); c) there is a special type of urbanization that is inherent in mountainous terrain, and different from the classical types of urbanization, the so-called "mountain character"; d) after the declaration of independence, various socio-economic problems emerged concerning employment, migration of population and the "spontaneous" movement of the population on the territory impacting generally on urbanization and planning.

2. METHODOLOGY

The term "agglomeration" in relation to resettlement was introduced by the French geographer M. Rouget, according to which agglomeration occurs when the concentration of urban activities goes beyond administrative borders and spread to the neighboring villages (Lappo, 1997).

The most common are two ways of formation of agglomerations, “from the city” and “from the area”.

The formation of agglomeration “from the city” occurs when a certain “threshold” in the town development makes that it is not possible to locate some urban functions on its territory so they are located in satellite settlements. At the same time there are facilities in its suburban area that are attracted to the city itself.

The development of the agglomeration “from the area” is typical for resource zones, for instance in areas of the mining industry, where there is a group of villages or towns that share one specialization. Over time, one of them having a better position and better conditions for development, becames the center, and the rest of the settlements - its satellites.

In a paper concerning urban issues, Pertsik (1991) identified the main methodological aspects which in our view constitute a complete picture and is characterized by a modern concept. The main directions in the field of urbanization have been identified: the development of a geographical theory of the city; strengthening links between fundamental concepts (interaction of territorial patterns of production and increased resettlement contrast, the use of the effect of the interconnected settlements, including the analysis of the potential of large cities and agglomerations, the analysis of economic and geographical position, the system analysis of the environment and taking into account the long-term consequences of its transformation, etc.); the development of geographical approaches and urban development of prediction methods (especially the methods of quantitative measurements and qualitative assessments to establish the theory of inertia of urban systems, etc.); identification of the objective laws that underlie the processes of city development; creation of the theory and morphology analysis methods for urbanized systems of different taxonomic rank (demographic, socio - geographical, urban planning mark in their different areas and parts has to be different, often opposite directions, which requires a comprehensive study of thorough identification, modeling of these zones and parts). It is necessary to develop new approaches to the analysis of economic and geographical systems of urban entities, their population cycles of life, the modeling of social conditions in the different areas and parts of the management of the development of the agglomeration, the mathematical modeling of urban systems and much more.

Special attention in our opinion should be given to the methodological aspects provided by G.M. Lappo (1997), in a study of the factors regarding the urban development theory. They have a significant relevance in the concept of urbanization and the degree of interaction between the natural environment and the urban systems.

3. OBJECT OF STUDY

The capital of the Kyrgyz Republic, Bishkek, is located in the North of the country, in the central part of the Chui Valley in the piedmont plain of the Kyrgyz Ala-Too at altitudes of 700-900 meters above sea level. It has developed for more than a century of its existence from a small post office into a major industrial and cultural center of the country. In the last 14-15 years, the rate of urbanization was spontaneously high. Around the city the so-called housing estates expanded. They are built up with low-rise buildings without infrastructure, which significantly worsened the sanitary-epidemiological and ecological situation.

According to the classification by J. Gibbs (1963, the theory of "differential urbanization"), the current state of Kyrgyzstan capital corresponds to the 4th stage of urbanization: "Concentration of population in major cities and at the same time reducing the number of small settlements". However, there is a local feature of the urbanization process - it takes place in an exaggerated way as there is population concentrated in excess in one city, about 20% of the total population. At present, the population of Bishkek according to independent experts is about 1.3 million inhabitants. Given the annual population growth rate of 2-3%, the estimated number of population of the city in 25 years can double and would exceed 2.5 million inhabitants. And this is without considering the possible political upheavals, demographic "booms" and waves of internal migration.

Target demographics, traffic problems and engineering - geological constraints cause the use of flexible linear-ring forms of urban plans and sectoral planning structure. The combination of a sectoral model, when functional areas are linked to the main thoroughfares of the radial and linear model and when the areas are located parallel to each other, allow for a full solution to the complex problems of urban Bishkek (NISI, 2015).

As one of the local experts, K. J. Bokonbaev (2014), noted: "The uncontrolled urbanization causes the problem of food security. All over the world there is not enough arable land, nearly a billion people lack food products. In Bishkek, 30-40 years ago, the land around the capital, where slums are now built, was arable – on the site of agricultural land we are building a concrete jungle, depriving people of food safety basics. This is not normal. Of course, it is possible to expand the city, covering the entire territory from Belovodsk to Tokmak, building a huge metropolis on the site instead of fields, but it will end in disaster, because the agricultural land will disappear while the need to feed the population – no" (Dyldaev & Bokonbaev, 2008).

On the basis of the main features of the satellite towns, the transport accessibility (1.5 hours) and the concentration of production and labor in them, the satellite cities of Bishkek agglomeration could become a part of the city. In this way, Bishkek would expand to the East including Tokmok and to the West, to Kara-Balta city and in the future they could be joined by the cities of Kaindy (West) and Kemin (East).

An important task at the moment is to find a solution for the socio-economic problems of small towns. In this regard, there is need for an integrated approach of the inevitable new residential policy - shaping Bishkek agglomeration with surrounding satellite cities.

Of particular note is the negative impact of the Bishkek industrial unit on the land resources in Chu Valley. In recent years, the distinctive feature of cities in developing countries is a sharp rise in their population due to immigrants from the countryside. This situation is typical for Bishkek, the capital of Kyrgyzstan. The growth of urban population usually leads to the expansion of the territories covered by these cities. The issue is that the surroundings consist of very valuable agricultural land. The urbanization of these areas, the replacement of agricultural land by governmental residential areas makes it difficult to supply the same urban population with food. This negative impact of urbanization is characteristic not only for the surrounding areas of Bishkek, but also for Chui and Fergana valleys. The irrigated fields around our cities are among the most valuable resources according to the website www.central-asians.ru.

Regarding the current situation in Bishkek, the exaggerated development of the city came to the point where the existing of socio-economic problems have become ubiquitous and negatively affect the quality of life of Bishkek. It is well-known that the urban infrastructure has suffered an overpressure in recent years. The city began to choke because of the traffic which sharply escalated the problem of connecting people to the public resources, new homes, as the wave of migration is difficult to control.

However, one can not underestimate the danger of unregulated development of the surrounding communities, as evidenced by the experience of many countries caught in such circumstances where the imbalance between the city center and the small towns surrounding it lead to a crisis. The underdeveloped periphery, especially represented by small towns brings a significant limitation to the development of capital.

In general, analyzing the overall environmental situation, the current environmental crisis in its main features is visible in the following areas: the accumulated volume of industrial, agricultural and household waste, which disrupts the natural biological cycles and significantly reduces the area of productive land; the dumping of huge quantities of industrial and domestic waste water in river systems without treatment; the pollution with fuel combustion products (soot, sulfur oxides, etc.) impacting on the composition of the urban air; the sharp increase in the range of noise, vibration, radiation, adversely affecting the vital functions of plants, animals and people (Dyldaev & Bokonbaev, 2008).

All these processes affect the degree of ecological balance in the urban areas and the number of zones with different environmental and economic regimes - development zones, the ecologically balanced areas, the buffer zones and compensation areas.

One of the main criteria for achieving sustainable development and ecological balance in the urban system of Kyrgyzstan is to determine the environmental capacity of the area which accounts for the demographic capacity relative to environmental components.

In addition to the demographic capacity of territory, other engineering and environmental characteristics are also important: the reproductive capacity of the territory, the geochemical activity and the overall environmental capacity.

Equally important for the sustainable development of urban areas is the assessment applied in the evaluation of environmental damage, which requires additional costs associated with the need to eliminate the pollution of the environment, to stop its destruction and the depletion of mineral resources and to restore the natural ecosystems. Environmental damage has reached enormous proportions, adversely affecting the economy of the city. The changing properties of nature provide that the stability of the resource base is lost. It affects the national wealth, it changes the conditions of labor force reproduction and the way people live.

It is clear that there is a large scale of anthropogenic impact in the cities and other populated places on the components of the natural environment which is also related to the deep global climate changes, the degree of urbanization, the forms of organization of the economy, the resettlement and the growth of industrial enterprises. An important factor is the uneven and sometimes chaotic location of the sources of pollution within the urban area. This in turn leads to the fact that the level of negative impact on vegetation, wildlife, and other natural elements is not the same in different functional areas of the city.

A key result of the urbanization policy and territorial development should not be a simple increase in the proportion of the urban population, but a fundamental change in the spatial pattern of the region.

Urbanization thus becomes a new challenge for cities and urban infrastructure, which belongs to the category of the most energy-intensive, labor-intensive and capital-intensive industries. With the steady rise in prices for energy resources it becomes more problematic to keep the central heating system, gas and other spheres of public utilities, which traditionally occupy a leading position in terms of consumption of non-renewable energy resources. It is expected in the near future that the Central Asian governments will be forced to resort to rationing the release of natural gas, electric and thermal energy and to introduce new town planning norms and standards. Thus, urban studies represent a new challenge in the field of technological renovation and modernization of the urban economy, and not only of the city.

4. CONCLUSIONS

Urban development processes in the Kyrgyz Republic have been set off gradually and must go through the following stages of urbanization:

- Spot the development of cities. The transformation of the rural economy into an urban one, the agricultural functions in industrial ones. This requires a balanced territorial development of the economy.
- Formation of agglomerations. The policy should be focused on the development of geographically linking transport and communication systems and infrastructures.
- Formation of the support framework of the settlements. Further increase of the economic density and the "contraction" of the territories, and a further development of cities.

Thus, urbanization and the formation of agglomerations around the megacities affect the issues of territorial distribution of industrial enterprises and transport infrastructure.

Therefore, there is a need for comprehensive strategic programs, which would secure the main directions of urban policy. They should include new forms and instruments of implementation (urban / municipal management system, urban autonomy, urban budgets, funding for urban infrastructure), with the inclusion of mechanisms for monitoring the implementation of government programs.

In general, the setting of an urbanized system, a territorial organization of economic potential and resettlement within the administrative-territorial reform carried out by the state, has an enormous role in the development of the economic potential of the whole country as a result, therefore it must necessarily be reflected in a steady eco-friendly economic development.

REFERENCES

1. Centre of Economic Research – CER (2010). *Improving City Management System in Small and Medium Cities of Uzbekistan – Main Trends, Mechanisms and Instruments*, *Analytical Report* 2010/04, United Nations Economic and Social Commission for Asia and the Pacific – UNESCAP, Tashkent.

2. Centre of Economic Research – CER (2013). *Urbanization in Central Asia: Challenges, Issues and Prospects. Analytical Report*, United Nations Economic and Social Commission for Asia and the Pacific – UNESCAP, Tashkent, 70 p.
3. Dyldaev, M. M., Bokonbaev, K. J. (2008). *Environmental problems of the city of Bishkek. Monograph*, Bishkek, 124 p.
4. Gibbs, J. (1963). *The evolution of the population concentration*, Economic Geography, 39, 119-129.
5. *http://central-asians.ru/*
6. Lappo, G. M. (1997). *Geografiya Gorodov*, Edit. VLADOS, Moscow, 478 p.
7. Lucy, W.H. (1994). *If planning includes too much, maybe it should include more*, Journal of the American Planning Association, no. 60, 3, pp. 305 - 318.
8. MacRoberts, M. H., MacRoberts, Barbara (1989). *Problems of citation analysis: A critical review*. Journal of the American Society for Information Science, 1989, no. 40, 5, pp. 342 - 349.
9. NISI (2015). *Concept formation and development of the Bishkek agglomeration*. Report, Bishkek, 35 p.
10. Office of Management and Budget (2013). *Revised Delineations of Metropolitan Statistical Areas*, *Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance on Uses of the Delineations of These Areas*, Bulletin No. 13-01 (February 28, 2013), c. 2, US Department of Labor, Washington DC.
11. Pertsik, E. N. (1991). *Geografiya Gorodov* (*Geourbanistika*), Vysshaya Shkola, 45 p.
12. Stiftel, B., Mogg Rebecca (2007). *A planner's guide to the digital bibliographic revolution*, Journal of the American Planning Association, no. 73, 1, pp. 68 – 85.
13. The Law of the Kyrgyz Republic (2008). *On administrative-territorial structure of the Kyrgyz Republic*, issued on April 25, 2008, No. 65, Bishkek.
14. The National Statistical Committee of the Kyrgyz Republic (2014). *Annual Report*, Bishkek, 129 p.
15. United Nations (2011). *World Population Prospects: The 2010 Revision*, UNDESA Population Division, New York.
16. USSR Statistics Committee (1987). *National Economy of the USSR in 70 years: Anniversary Statistical Yearbook, Finance and Statistics*, Moscow.
17. World Bank (2013). P*lanning, Connecting, and Financing Cities – Now: Priorities for City Leaders*, World Bank, Washington DC.

STUDIA UBB GEOGRAPHIA, LXII, 1, 2017 (p. 87-104)
(RECOMMENDED CITATION)
DOI:10.24193/subbgeogr.2017.1.07

THE ADMINISTRATIVE –TERRITORIAL ORGANISATION AND THE AGE OF SETTLEMENTS IN THE AREA OF CODRU DISTRICT

SIMONA-MONICA CHITA[1]

ABSTRACT. – The Administrative – Territorial Organisation and the Age of Settlements in the Area of Codru District. The geographical area of the District of Codru has been inhabited since ancient times, as archeological evidence has demonstrated, the oldest settlements dating back to the Neolithic, within an age range of 4500 and 2500 years. The area of the District of Codru was settled by free Dacians, as the Dacian coins found here give evidence. This microregion was not incorporated in the Roman province of Dacia. The arrival and departure of various peoples who ruled over this area have left their mark not only on locals' life and history, but also on the administrative – territorial organization of the District of Codru. Successively, this area was organized into rural tribal communities, into principalities and voivodships (the microregion was part of the Voievodship of Transylvania), shires (during Hungarian rule), counties and *plase* (several communes forming a single administrative unit, in 1950), ministerial directorates (under Iuliu Maniu's government in 1930s), into regions (made up of districts, towns and villages - called *communes*), finally, divided into counties, towns, communes and villages. All these changes the area of the District of Codru has undergone, together with all the various rulling of peoples coming and going across the ages have not altered the identity and authenticity of the inhabitants of the microregion called the District of Codru.

Keywords: *age of settlements, administrative-territorial organization, the District of Codru*.

1. INTRODUCTION

Time passes incessantly leaving behind a history of events, a history which allows us to imaginarily travel back in its course, a history which mirrors a people's past, with their joys, hardships, sufferings, victories, defeats or failures. The history of a nation is like an album of memories comprising collections of local history of all the settlements and places inhabited by that particular people.

[1] *"Babeş-Bolyai" University, Faculty of Geography, 400006 Cluj-Napoca, Romania, e-mail: sgeografie@yahoo.com*

Browsing Romanian people's "history album", Vasile Iuga of Sălişte stated: "Romanians' history is one of a steadfast people, unitarily formed within the area of ancient Dacia. Within the natural borders of the Danube-Carpathian-Black Sea area the Romanian nation was formed and has permanently lived on this territory; our ancestors, the Geto-Dacians, who made up an organic group of people belonging to the greater family of the Thracians, created, since the dawn of man, one of the great ancient civilisations, comparable to that of ancient Greeks, Persians or Romans" (Iuga, 2015, p. 91).

Romanian people's history has been marked by various ups and downs, the people living on this territory have been forced to fight in order to defend their motherland against those who intended to gain ownership of it.

The District of Codru, located on both sides of Codru Ridge and Piedmont, has had a distinct history among those of other microregions/regions of Romania, this area playing the role of a transit zone, of a border territory separating different political realities since Dacian-Roman times, as the "land" actually lay along the Roman limes.

2. METHODS AND DATA USED

Several methods were applied in our research: literature review, data analysis, statistical methods, mathematical methods for data interpretation, cartographic methods (used for creating customized maps to render research data in a cartographic format) and synthesis.

3. THE AGE OF THE DISTRICT OF CODRU SETTLEMENTS

It is common knowledge that since ancient times people preferred to settle in areas where nature provided food sources and shelter to protect from danger. Therefore the area alongside the Someş River Valley and Codrului Hillocks became a favourable region for people to settle and develop social communities since times immemorial and antiquity.

To demonstrate the age of human settlements being established in the area of the District of Codru we took into account the archeological discoveries and historical documents which testify to the anthropization of the lands included in the District of Codru. As V. Băinţan also stated: "primitive people inhabited the area several millenia ago..." (Băinţan, 2000, p. 303).

The archeological diggings carried out in the area have documented traces of material and spiritual life dating back to 2000 – 1500 BC. In the 19th century, at Stâna (1872) in the southern part of the area (near its borderline), an archeological deposit of bronze artefacts was discovered; it included spears, bracelets, Celtic axes. In the early years of the 20th century, at Beltiug, in the western part of the District of Codru, a new archeological deposit was discovered: it contained such artefacts as hatchets, axes, a pin and a dagger – all of them made of bronze. Also, other artefacts were unearthed: the axe with a disc and a nail – used as a fighting weapon (found at Homorodul de Jos), the deposit of five axes (at Medişa). The ancient settlements found at Necopoi and Homorodul de Sus belong to the Suciu de Sus culture.

In 1960, at Corund, a bowl-shaped pot ("terra sigillata"), from the 3rd century BC was discovered. In 1964 and 1978, at Ghirişa, in the western part of our investigated area two treasure troves of Imperial Rome denari were found. The one discovered in 1964 contained 158 coins dating back from the reign of Vespasian (69 – 71 p.Hr.) to that of Septimius Severus (194 p.Hr.). The second trove consists of over 1000 coins dating back to a period starting from 71-69 BC to 20 BC.

Archeological research carried out on the territory of Oarţa de Sus (commune) shows that the oldest settlement dates back to the Neolithic period. On the hill of Oul Făgetului (Beechwood Egg), a Neolithic settlement belonging to the Tisa cultures was discovered, and on Măgurii Hill a Neolithic village belonging to the Tisa Polgar culture was unearthed. Along the same borderline zone, dating back to the same historical age, other archeological discoveries were made in Unghiului Valley, in Bicaz village (the necropolis of *Togul Nemţilor*). Dating back to the early Neolithic age, as well as to the early Aeneolithic period, the settlements found on the territory of the Commune of Homoroade (involving the Starcevo-Cris culture in Homorodul de Jos village). To the Neolithic age belongs the ancient settlement found at Supuru de Jos – Sentieului Hill, located on the high terrace of Crasnei River. A Neolithic settlement was also found on the territory of Oarţa de Jos, at the site of *Vâlceaua Rusului (The Russian's Clearing)*.

To the Aeneolithic and the transition period to the Bronze Age belongs the settlement called Tiszapolgár, or, respectively, Coţofeni. Besides the Coţofeni type pottery, found in the approximately oval – shaped hut, earthenware pottery of Baden culture was also found there.

The archeological research done on Oul Făgetului hill has revealed three stages of settlement: the bottom layer suggests a lifestyle belonging to the Suciu de Sus 2nd phase culture, the middle layer belongs to the Lăpuş 1st phase grouping, whereas the top layer indicates traits of the 2nd phase of Lăpuş culture. Some fragments of ceramics of Wietenberg type were also found.

At the site named Făget large amounts of earthenware objects or fragments of objects were found, dating back to the late Bronze Age, grouped under the Lăpuş type of culture. In this area a relatively large number of objects of black and red ceramics, fragments of tall belly-like shaped containers or pots, identical to those found in the first phase of the necropolis from Lăpuş (Kacsó, 2004, p. 54).

Archeological evidence tracing back to the Bronze Age, belonging to the Suciu de Sus, Lăpuș group type of culture was also identified at the sites of Mânzata, Citere, Costișa, on the southern and south-western slopes of Dealului Crucii (Cross Hill).

On the territory of Bicaz village archaeological excavations unearthed a tumuli necropolis of the late part of the Bronze Age, a cemetery located on a prolonged ridge whose tumuli were built in two stages. The first stage consisted in building a 1metre high mound, in the middle of which a hole was dug. Few fragments of pottery objects were found in this hole. In the second stage, the smaller mound was covered, and kerbed around with earth filling. The fragments of pottery objects found in the tumulus investigated presented a black channel-shaped decoration on the outside, and were of a red colour inside. This necropolis consists of 33 tumuli organized in a semicircular shaped plan and represent the burial places of local kings (or leaders), huge burial monuments in the shape of "local pyramids".

At the boundary point of Valea Unghiului, in the area of Bicaz commune two bronze archaeological deposits were also found. The first trove weighed 226,155 kg and consisted of pickaxes with tapering blade and peen, spear tips, daggers, sword blades, hatchets, bronze cakes, fragments of a halfmoon fretted pendant with rod with a longitudinal punched line, fragment of a sickle with a rest of casting, whole bronze cakes and fragmentary bronze cakes, pieces of unprocessed bronze ingots, fragmentary chisels. The second deposit weighed 142,481kg and consisted of whole and fragmentary pickaxes with tapering blade and peen, the blade of a Darjna type axe, fragmentary daggers, a sword blade, whole and fragmentary sickles, with a cross eye and longitudinal decorative lines, fragments of wing-flanged axe heads, spikes, diamond-shape cross section bracelets, Gutenbrunn type pin, fragment of a fibula, bent halfmoon pendants, wide folded belt plate, various pieces of molten bronze, aggregated in a slag, copper alloy casting waste, pieces of unprocessed copper, a fragment of narrow-width bronze strip, fragments of bronze cakes, etc. (Kacsó, 2004, p. 57). Analyzing the objects found in the two Bronze age deposits on the territory of Bicaz commune, specialists came to the conclusion that the pieces included in the first deposit (Bicaz I) are older than the ones belonging to the second deposit (Bicaz II). The older bronze objects had been made using a traditional technique in local foundry shops. The objects in Bicaz II seemed to come from foundry shops located more or less farther from the exaction place, apparently, imitations of the local foundry shop(s).

On Ghiile Botii Hill, in Oarța de Sus, a human settlement dating back to the Bronze Age was discovered, becoming one of the most important sites of the Bronze Age period testifying to the existence of some form of civilization in the Carpathian basin. In this area, a unique sanctuary belonging to the Wietenberg culture was discovered. The site is located right on the top of the hill, which underwent artificial elevation too. The central ditch of this sanctuary and the holes dug around must have been used for animal and human sacrifices as a burial place, along with pottery, metal objects, dies for metal casting, objects mad of bone, stone and baked clay. The research conducted in 2003 at Stremţului Hill site uncovered fragments of an above-ground hut (or house) of the Suciu de Sus culture, a living place with two hearth fireplaces, one of which was rebuilt three times.

In 2005, at the site of Giorocuţa, a bronze artefacts deposit was discovered, dating back to 1000-900 BC. The deposit consisted of two axe heads, two sickles, a bracelet and a chisel.

In the same borderline area, Oarţa de Sus-Bicaz, excavations unearthed gold and silver objects, coins, golden bracelets, spiral bracelets, over 100 pottery objects, decorated with spiral- like or geometric motifs, using incision techniques. Many of these are kinds of objects which had never been found elsewhere in the same cultural area they belong to. They give evidence of the existence of a flourishing Dacian settlement in this researched area dating back to 2nd and 1st centuries BC. This Dacian settlement is located in Măgura village.

The presence of our ancestors the Dacian – Gets, later that of the Dacian – Romans on the hillsides and valleys of Codrului Ridge and Piedmont is certified by archaeological evidence recently found. A recent piece of evidence was produced by the school children living along the borderline of Oarţa de Sus, in the hilly area of Sălaj Valley. They found a treasure of coins scattered in the fields of their farms, dating from the times of Roman Empire rule in Dacia (Băinţan, 2000, p. 303). The treasure trove consisted of 303 silver denari, a huge fortune at that time. Roman coins were also found along the borderline of Băseşti village, which attests the development of civilisation, economic and cultural relationships during that period of the local Romanian population living in the area on both sides of the administrative border. This was also due to the geographical closeness to the Roman limes of the District of Codru area.

The most spectacular aspect is represented by the occurrence of the name of "Bodava", which refers to the largest part of the borderline area of today's town of Ulmeni. It is located in the south – western part of the town (in Someş-Uileac village), where traces of an existing material civilisation of the Dacian Gets, as well as their interactions with the Roman Dacians in the central part of Transylvania.

The Romanian people's continuity of existence on this territory is also attested by ***historical documents***, which proved as false the theory according to which the Romanians living in Transylvania have not lived here for millennia. Among the written documents mentioning the continuous existence of the Romanian populace on this territory is the Chronicle by Anonymus (*Gesta Hungarorum*), a notary of king Bela, which was written in the 12th century and disputed by many Hungarian historians. The Chronicle described how the Hungarians settled on the plain of Pannonia and also made a presentation of Transylvania.

In addition to the archaeological discoveries and written historical documents, the ***ethnographic heritage*** is of significant relevance to the effort of documenting the continuity of the Romanians in the District of Codru area. Despite the often harsh living conditions they have had to face, the inhabitants of Romanian ethnicity living throughout their country's territory have been creating a rich material and spiritual folk culture. The features indicating this continuous existence can be identified in the preservation of old trades or occupations (farming and sheep herding), the way folk costumes are made and worn and folk a architecture in rural areas.

To support the idea of Romanian population's continuity in the District of Codru area the linguistic argument can also be mentioned. The existence of some Latin origin words which are not commonly used in other regions of the country in today's language and are preserved only in the District of Codru patois is an example in this respect. For instance, the verbs *to gain* or *earn,* used sometimes with a reflexive object, too, has preserved a 16th meaning : *to tend to something, or look after somebody* in the locals' language. (e.g. When I was a little girl I used *to gain* the cows"). Another Latin origin word is *vipt*, coming from *victus* (meaning "nourishment") has currently the meaning of food you take with you for a trip, or while travelling, not regular, homemade meal. The Dacian – Roman origin of the settlements in Codrului Country area is augmented by vocabulary items of used in the ancient times, still preserved in today's speech: vatră, beci, codru, ţarc, strungă, domn, uşă, casă (meaning: *hearth fireplace, cellar, forest, pen, sheep's forcing pen, lord, door, house*).

Information on the ***authenticated acts of foundation of the settlements (localities)*** is usually presented in written formal documents. However, these documents are not always accurate in certifying the actual age of the settlements. The earlier documents only mention that these localities were the first by a particular name on a particular territory at a certain date when the authority representative or a legal body issued the document.

It should be noted that the Romanian villages in the District of Codru, as well as other localities founded throughout Transylvania were not authenticated as being settled at a particular date in the course of history, but were attested at a later date. They were mentioned only when a legal document issued by the Hungarian king or voivod involved their submission in bondage to the new Hungarian noblemen who were granted or donated the land where the locality was. Transylvania was completely conquered by the Hungarian kings in the 13th century. Therefore, these localities first appeared mentioned as existing by their name in a legal document since that period.

Table 1. Authenticated Acts of foundation of the settlements in the area of the District of Codru

Locality	Authenticated Act of Foundation	Locality	Authenticated Act of Foundation
Ardusat	1231	Lipău	1409
Arduzel	1334	Măriuş	1424
Ariniş	1543	Mânău	1423
Asuajul de Jos	1391	Medişa	1273
Asuajul de Sus	1391	Motiş	1387
Babţa	1383	Necopoi	1828
Băiţa de sub Codru	1475	Oarţa de Jos	1391
Băseşti	1391	Oarţa de Sus	1391
Bârsăul de Jos	1470	Odeşti	1424
Bârsăul de Sus	1470	Ortiţa	1391
Beltiug	1216	Poiana Codrului	1648
Benesat	1475	Pomi	1407
Bicaz	1424	Racova	1393
Bicău	1394	Răteşti	1423
Biuşa	1388	Rodina	1954
Bogdand	1383	Roşiori	1409
Bolda	1648	Sălişte	1424
Borleşti	1585	Sălsig	1387
Buzeşti	1684	Sâi	1424
Chilia	1370	Sârbi	1424
Ciuta	1461	Socond	1424
Corni	1451	Soconzel	1424
Corund	1423	Solduba	1475
Crucişor	1231	Someş Uileac	1383
Cuţa	1424	Stâna	1648
Fărcaşa	1424	Stremţ	1410
Gârdani	1424	Supurul de Jos	1215
Gerăuşa	1424	Şandra	1387
Giorocuta	1423	Tămaia	1231
Giurtelecu Hododului	1378	Tămăşeşti	1424
Hodişa	1271	Tătăreşti	1411
Hodod	1334	Tireac	1954
Homorodu de Jos	1273	Tohat	1424
Homorodu de Mijloc	1394	Ţicău	1543
Homorodu de Sus	1273	Ulciug	1387
Hurezu Mare	1424	Ulmeni	1405
Iegherişte	1272	Urmeniş	1391
		Viile Satu Mare	1909

Source of data: Data were retrieved from Suciu, C. (1966)

Analysing the data presented in Table 1 we note that 8 localities were authenticated as founded in the 13th century: Crucişor, Beltiug, Homorodul de Sus, Homorodul de Jos, Iegherişte, Ardusat, Hodişa, Medişa. A century later, formal documents stating the existence of the localities on the opposite side of Codrului Ridge were issued. Therefore, the settlements of Giurtelec (1378), Babţa (1383), Motiş (1387) are acknowledged; the villages settled in the middle of wooded lands, over the hill tops followed: Urmeniş, Băseşti, Asuajul de Jos and Asuajul de Sus, Oarţa de Jos, Oarţa de Sus and Orţiţa. By the 17th century, almost all the villages in the Codrului Country area were recorded as existing in formal legal documents.

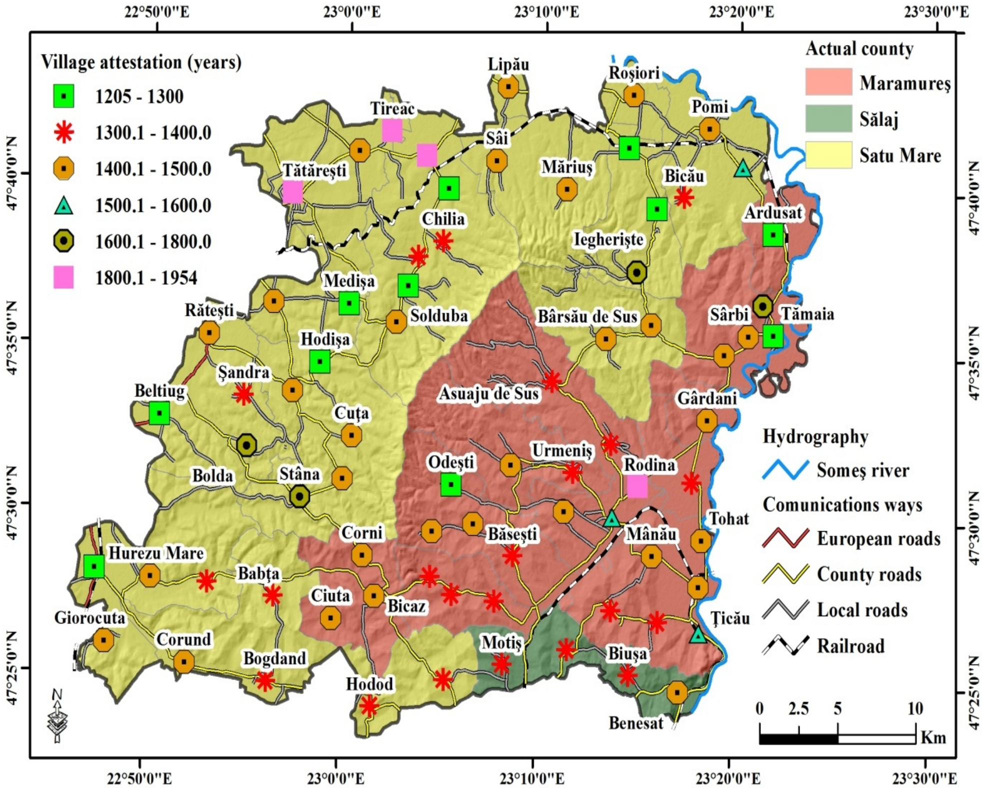


Fig. 1. Authenticated Acts of foundation of the localities in the area of the District of Codru

4. THE ADMINISTRATIVE-TERRITORIAL ORGANISATION OF THE AREA FROM DACIAN PERIOD TO PRESENT

The Dacian-Roman period is marked by the existence of the Free Dacians in the area of the District of Codru as this territory was not incorporated in the Roman Dacia Province, thanks to the natural obstacle of the woodlands the Romans should have faced. However, as a population living in the neighbouring area of the Roman limes, the Free Dacians from the District of Codru developed social and economic relationships with the colonists and the former Dacians now subdued. These relationships between the population of Free Dacians and Dacian –Romans strengthened more after 275 when the Imperial Roman army and administration were withdrawn by the emperor Aurelianus. In the second half of the 7th century, the Slavs migrate and settle temporarily on the territory of Transylvania and the area of the District of Codru, too.

Towards the end of the 9th century and in the beginning of the 10th century AD, the communities inhabiting today's Romania territory began to organise their social –economic and political life better and more thoroughly. Historical written documents and archaeological evidence provided information about the evolving civilisation of the new Romanian people The main farming of the land and livestock breeding occupations are better illustrated in the archaeological deposits and sites and by the chronicles of the time. There have been found charred seeds of millet, wheat and barley found in earthen storage holes, plow blades, domestic animal bones, bells for cattle, fishing tools, fishing bones and scales found in various archaeological sites on the territory of the area researched and other places in Romania. Exploitation of underground raw materials and minerals at the time is proves by the foundry holes and corfs, and by the written records of gold and salt mining. (Pascu, 1971, p. 13).

As far as the level of advancement in social organisation and degree of civilisation are concerned, evidence of the period comes from the existence of rural communities being organised into ***associated rural territorial communities***, led by a judge, a cneaz (prince) or by „the council of good and old people", elected from among the members of the community, and elected by the village community, from the evaluation of the activity of non-hierarchical communal institutions: "villagers customary law courts, villagers' military organization to defend property and people, tax collecting organization, and distribution of rights and obligations among the members of the associated communities with respect to communal land ownership and to one another. (Pascu, 1971, p. 14).

Concerning the use of the term village community instead of the term council (obște), Ion Aurel asserted in the introduction of the work „ Diplomas from Maramureș from the XIV-XVIII centuries, originated from Ioan Mihalyi of Apșa's collection", the fact that " we intentionally do not use the term "obște", very much used in the years of the communist regime and which makes us think about an egalitarian world, without social differentiations, which most often would have existed only in the Marxist-Leninism ideologists' imaginations. The word council (obște) has Slavonian origins and is not attested from the oldest Romanian texts. It was revigorated in the Stalinist decade at the same time as other mandatory loans from the great Eastern neighbour.

As the time went by and the communities developed, the society underwent changes in its political organisation, thus, the associated rural territorial communities were grouped into larger confederations called ***cnezate,*** a type of small formations led by a prince (cneaz). The prince (cneaz) can rule either over 1-2 villages or 15-20 villages placed through a valley. Besides the fact that these princes gained from the peasants' work, they had the ability to protect these workers of the land, to organize the community's life and to ensure the safety of everyday life. The villages that were under the rule of the princes "could be inherited, sold, changed, pledged after rooted, well known and well applied legal principles which are part of the habitual dowry of the Romanian and voivodal right" (Ioan Aurel Pop in the introduction of the work "Diplomas from Maramures from the XVI-XVIII centuries, originated from Ioan Mihalyi of Apșa's collection").

The more complex formations, in which the Romanian villages were organized, are those of the voivodal district, ruled by voivods chosen by the voivodal gathering which had the supreme and military power. The IX-XI centuries are marked by the membership of the District of Codru to **Menumorut's Voivodeship** (Menumorut's dukedom-in Anonymus' chronicle), situated to the north of Banat which extended from the north of Satu Mare up to Mures and from the plain of Tisa to the Padurea Craiului Mountains (Igfon forest) and the Gates of Meseș (Pascu, 1972, p. 30). From the information given by Anonymus it results that this voivodal district had a certain dependency towards the Byzantium, the voivodeship not being conquered, Menumorut forcibly accepting the Magyar suzerainty. The 10th century is marked by the beginning of the Magyar conquest of Transylvania, conquest that took place in more stages (from the year 900 up to 1200). During this conquest the Magyar people sought to have the local rulers by their side- the princes and voivodes, a part of them joined the Magyar power due to the desire to become feudal rulers.

As the time went by and the communities developed, the society underwent changes in its political organisation, thus, the associated rural territorial communities were grouped into larger confederations called ***cnezate,*** a type of small principalities or micro-national duchies, and ***voivod-led pricipalites***, more complex political and social (pre)-statal formations.

The expansion of the Magyar rule brings a new administrative and political organization, the **counties** (12 th century), the human settlements from the District of Codru being part of the Satu Mare county, also named Sătmar, and Middle Solnoc (Giurescu & Giurescu, 1976, p. 55). The settlements from the northern part of the district are part of the Sătmar county (the ones from Colinele Codrului and from the north-east of Culmea Codrului), and the Middle Solnoc had the settlements from the current Sălaj district and the ones from the hills from the South-East of Culmea Codrului.

In the 14th century these areas were ruled by Voivod Balc (Maramureş) and Voivod Drag (Sătmar), and in the 15th century a part of the villages belonged to the noble family of Dragfi (Dragoș).

In 1849, based on the Austrian imperial constitution, the autonomy of the Transylvania principality is reestablished, and the Zarand, Crasma, Middle Solnoc counties and the Chioar district (from Partium) are once again attached to this territory. If in 1848 the administrative-territorial organization was the one of counties, September 1849 brings a new organization arranged by Transylvania's governor Ludwig von Wolghenuth - the one of districts, which were ruled by a military commander helped by a commissioner (tab. 2).

Table 2. The administrative territorial organisation in 1850-districts, constituencies and circles

District	Constituency	Circle	Component villages
Cluj Military District	Dej Constituency	Cehu Silvaniei Circle	Arduzel, Ariniş, Asuajul de Jos, Asuajul de Sus, Băiţa de sub Codru, Băseşti, Bârsăul de Jos, Bârsăul de Sus, Benesat, Bicaz, Biuşa, Ciuta, Corni, Gârdani, Giurtelecu Hododului, Mânău Motiş, Oarţa de Jos, Oarţa de Sus, Odeşti, Ortiţa Sălişte, Sălsig, Someş Uileac, Stremţ,Tămăşeşti Tohat, Ulciug, Ulmeni, Urmeniş
	Şimleu Silvaniei Constituency	Eriu Circle	Babţa, Bogdand, Giorocuţa, Hodod, Corund, Supuru de Jos

Source: The 1850 census, Transylvania- Rotariu, T., Semeniuc, Maria, Mezei, E.

This organisation did not last long, until May 12 1851, when based on the imperial rescript the Transylvania territory was divided into 5 counties (Sibiu, Alba Iulia, Cluj, Bistriţa, Odorhei) with circles and subcircles, organization which resisted until the beginning of the 7th decade (tab. 3).

It appears that this century is fated to some frequent changes concerning the administrative-territorial organization of the Land of Codru, a fact also argued by the decree issued in March 24 1861 based on the cancellation of Transylvania's absolutist administration and the return to the old administrative unities, **counties**, unities present before the year 1848 (Table 4).

Table 3. The administrative-territorial organisation in circles (cercuri) and hundreds (plase)

Circle (cercul)	Hundred (Plase)	Component villages
Şimleul Silvaniei	Cehu Silvaniei	Arduzel, Ariniş, Asuajul de Jos, Asuajul de Sus, Babţa, Băiţa de sub Codru, Băseşti, Bârsăul de Jos, Bârsăul de Sus, Benesat, Bicaz, Biuşa, Ciuta, Corni, Gârdani, Giurtelecu Hododului, Motiş, Oarţa de Jos, Oarţa de Sus, Odeşti, Ortiţa, Sălişte, Sălsig, Someş Uileac, Hodod Stremţ,Tămăşeşti, Ţicău,Tohat, Ulciug, Ulmeni, Urmeniş
	Tăşnad	Bogdand, Giorocuţa, Corund, Supuru de Jos

Source: The 1857 census, Transylvania, 1996, editors: Rotariu, T., Semeniuc, Maria, Mezei, E.

Table 4. The admnistrative-territorial organisation into counties and hundreds

County	Hundred (Plase)	Component villages
SATU MARE	Ardud	Beltiug, Bolda, Stâna, Gerăuşa, Hodişa, Homorodu de Jos, Homorodu de Mijloc, Homorodu de Sus, Sâi, Socond, Racova, Necopoi, Cuţa, Medişa, Hurezu Mare, Chilia, Tătăreşti, Şandra, Răteşti, Soconzel, Solduba
	Baia Mare	Ardusat, Fărcaşa, Tămaia, Sârbi, Buzeşti
	Satu Mare	Lipău
	Seini	Borleşti, Iegherişte, Poiana Codrului, Măriuş, Bicău, Pomi, Crucişor, Roşiori
SĂLAJ	Cehu Silvaniei	Arduzel, Ariniş, Asuajul de Jos, Asuajul de Sus, Babţa, Băiţa de sub Codru, Băseşti, Bârsăul de Jos, Bârsăul de Sus, Benesat, Bicaz, Biuşa, Ciuta, Corni, Gârdani, Giurtelecu Hododului, Motiş, Oarţa de Jos, Oarţa de Sus, Odeşti, Ortiţa, Sălişte, Sălsig, Someş-Uileac, Stremţ, Tămăşeşti, Hodod, Tohat, Ulciug, Ulmeni, Urmeniş, Bogdand
	Tăşnad	Giorocuţa, Corund, Supuru de Jos

Source: The 1869 census, Transylvania, 1996, eds: Rotariu, T., Semeniuc, Maria, Mezei, E.

The end of World War I is marked by a good news, the one of stitching to the "mother-country" of the historic provinces Transylvania, Bessarabia and Bucovina. As a consequence, in 11/24 of December 1918 a new decree was issued regarding Transylvania's organization, according to which this province has been divided in 23 districts, made of shires the village being the inferior unity. Based on this the territory of District of Codru belongs to the districts Sălaj and Sătmar.

During the reign of Prince Alexandru Ioan Cuza, according to the princely decree no. 495/1862 and The Act of Law no. 396/1864 the main administrative territorial division of the state was the ***judeţul (county)***. Each county was subdivided into ***plase*** (***hundreds*** or ***districts***)[2] led by subprefect, and each hundred was divided into **communes (villages)**.

Table 5. The administrative territorial organisation into counties, hundred (plăşi) and communes in District of Codru

County	Hundred (Plasa)	Commune	Component Villages
SĂLAJ	Plasa Cehu Silvaniei	Arghihat	Asuajul de Jos, Asuajul de Sus
		Băiţa	Odeşti, Urmeniş
		Bârsăul de Sus	Bârsăul de Jos
		Băseşti	Sălişte, Urmeniş
		Bicaz	Corni, Stremţ
		Biuşa	Uileac
		Bogdand	Babţa, Corund
		Hodod	Ciuta
		Leleiu	Giurtelecu Hododului
SĂLAJ	Plasa Cehu Silvaniei	Oarţa de Jos	Moţiş, Oarţa de Sus, Ortiţa
		Sălsig	Gârdani, Mânău
		Silimeghiu	Arduzel, Chelinţa, Tohat, Ţicău
SĂTMAR	Plasa Arded	Homorodul de Jos	Chilia, Necopoi
		Medişa	Gerăuşa, Hodişa, Homorodul de Mijloc, Homorodul de Sus, Solduba
		Socond	Cuţa, Soconzel
	Plasa Baia Mare	Ardusat	Buzeşti
		Fărcaşa	Sârbi, Tămaia
	Plasa Seini	Crucişor	Bicău, Huta (Iegherişte), Poiana Codrului
		Pomi	Borleşti
		Valea Vinului	Măriuş, Roşiori

Source: The Dictionary of Transylvania, the Banat and other incorporated territories 1922-Martinovici, C., Istrati, N.; The 1869 census, Transylvania, 1996 Rotariu, T., Semeniuc, Maria, Mezei, E.

[2] Plasa (Hundred) – a subdivision of a county in the former administrative organisation of Romania

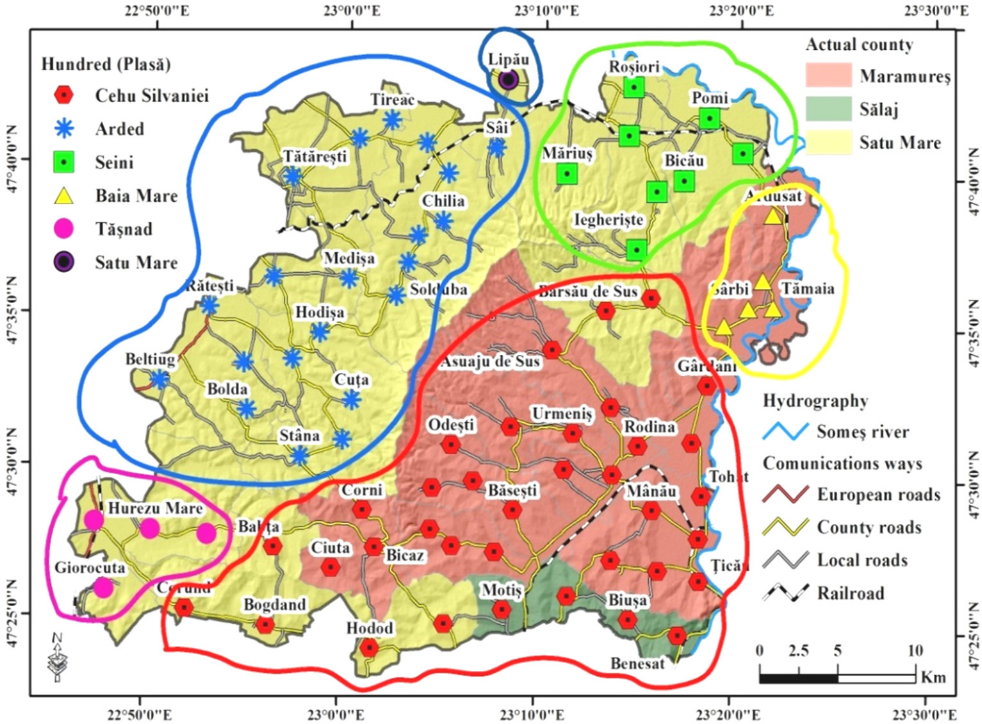


Fig. 2. The administrative territorial organisation into hundred (plăşi) and communes in District of Codru

On 3rd August 1929, the Romanian government of the Peasants' Party, led by Iuliu Maniu, adopted a new law of the administrative-territorial organisation of the country, through which decentralisation of local administration was aimed. The provisions of this act stated that the territory of Romania was divided into ***7 ministerial directorates***. Consequently, the researched area is incorporated into the Ministerial Directorate of Cluj. However, this local administration re-organisation lasted for only two years.

The last interwar local administration and territorial reorganisation reform was implemented during the reign of King Carol II. Starting with 14th August 1938, Romania's territory was divided into units called ***ţinuturi*** (approximate translation ***lands). Ţinutul*** was conceived as a "territorial constituency" with juridical personality, able to represent local people's interests and exert its rights and responsibilities for general local administration (Săgeată, R., 2013, p. 8). But this territorial division lasted for only two years. In 1940, the ***counties*** regain their status of legal entities. In the light of the 1938 reform of local administration, the territory of the District of Codru belonged to the land of Someş.

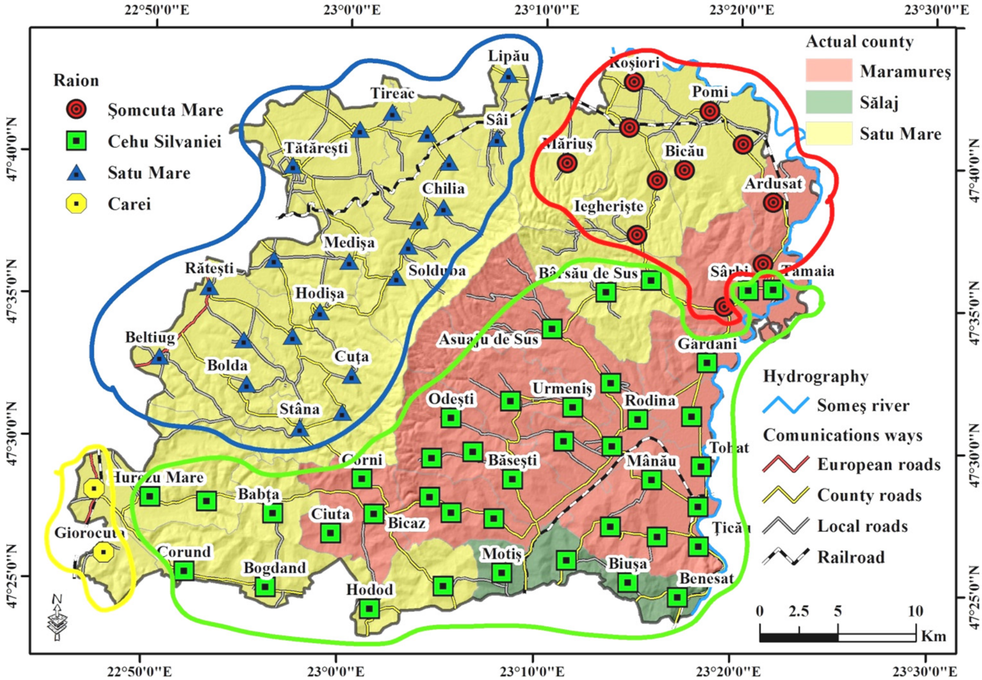


Fig. 3. The Administrative- territorial organisation into rayon of the area of the District of Codru

In 1945 the first pro-Soviet government came into power in Romania. This government brought significant changes to the local administration of the country. Thus, in 1950, according to the provisions of The Local Government Act no.5/ 6th September 1950, the division into counties was eliminated; all divisions were replaced by regions made up of ***raioane*** (approximately ***rayons*** or ***departments***), ***cities and communes***. These division units were no longer based on the criterion of economic complexity, geographical and historical specificity, but were only meant to support in a straightforward manner the decisions and rule of central administrative and political state bodies.

This new administrative territorial organisation, imposed from abroad by the Soviet power officials, to mirror their model of local government led to repeated adjustments to administrative policies. Thus, in 1958, after the Soviet troops were withdrawn from the Romanian territory, the political Communist leaders in Bucharest distanced themselves from Moscow's politics and a new administrative-territorial organisation was established. On the 17th February 1968, the Local Government Act introduced two basic levels of local government, the territorial units being the ***județ (county)***, at the higher level and the ***city or commune*** at the lower level.

Analyzing from a comparative point of view, the administrative-territorial organisation of the settlement network from the District of Codru in two different moments, we can see that, based on the 1894 organisation, the District of Codru spread the span of two counties (Sălaj and Maramureș), and at present this land spreads over a surface of three counties (Maramureș, Sălaj, Satu Mare), some of the villages that belonged to Sălaj have passed to Maramures, for exemple, Băsești, the town of Ulmeni (town since 2004, after a vote), Băița, Sălsig, Oarța de Jos, Bicaz, etc. Also, one can observe how some movements of villages from one county to another, like Manau from Sălsig to the town of Ulmeni, Bicău from Cuscior to Pomi, Odești from Băița de sub Codru to Băsești, Motiș from Oarța de Jos to the town of Cehu Silvaniei, etc.

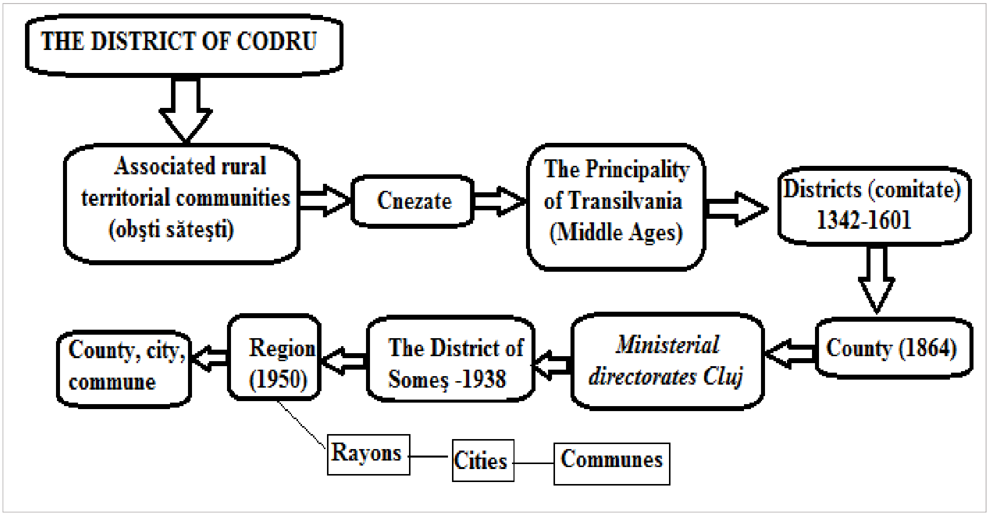


Fig. 4. The Evolution of the administrative- territorial organisation of the District of Codru

After 1968 the territory corresponding to the Districts of Codru overlaps three administrative units: the county of Maramureș, the county of Satu Mare and the county of Sălaj. Belonging to the three administrative units had a beneficial effect over the foresters because it makes the 3 administrative units cooperate towards developing this ethnographical region, to make known the cultural values of the foresters, to bring them out of anonymity.

5. CONCLUSIONS

Reviewing the archaeological discoveries and written records relative to the area of the District of Codru we note that this territory, as well as the whole national territory, has been inhabited since early stages of human history, and that the earliest settlement dates back to the Neolithic Age, finding itself under various foreign dominations. A fact is certain, that the district never was part of the Romanian province, but it was occupied by the Magyar people, in that era being attested most of the villages of the land. Worth a mention is the fact that Romanian villages from the Land of Forests, as well as the whole of Transylvania do not date from hen they are attested, but are much older. They were attested in writing only when they were given responsibilities and attributes towards the new lords to whom they were given, respectively during the Magyar rule. Transylvania was conquered fully by the Magyar kings in the 11th century, so they are attested since that time.

REFERENCES

1. Băințan, V. (1997). *Ardusat: străveche vatră românească*, Edit. Cybela, Baia Mare.
2. Băințan, V. (2000). *Băsești, “Mica Romă” de sub poalele Codrului: contribuții istorice*, Edit. Cybela, Baia Mare.
3. Bolovan, I. (1998). *Organizarea administrativă şi dinamica populaţiei Transilvaniei între revoluţia de la 1848 şi primul război mondial*, Anuarul Institutului de Istorie "George Bariţiu" din Cluj-Napoca. Seria Historia, vol. XXXVII.
4. Butură, V. (1978). *Etnografia poporului român: cultură materială*, Edit. Dacia, Cluj-Napoca.
5. Ciordaş, R. (2012). *Termeni juridici în obiceiurile populare din zona Codru*, teză de doctorat.
6. Giurescu, C., Giurescu, D. (1976). *Istoria Românilor. De la mijlocul secolului XIV până la începutul secolului XVII,* Edit. Ştiinţifică şi Enciclopedică, Bucureşti.
7. Dăncuş, M., Dincă, A.D., Mârza Andreea, Pop, I.A. (2012). *Diplome maramureşene din secolele XVI-XVIII, provenite din colecţia lui Ioan Mihalyi de Apşa,* Academia Română. Centrul de Studii Transilvane, Cluj-Napoca.
8. Iuga, V. (de Sălişte) (2015). *Monografie Odești – 810 ani de atestare documentară, 1205-2015,* Edit. Dragoş Vodă, Cluj-Napoca.
9. Kacsó, C. (2004). *Mărturii arheologice,* Edit. Nereamia Napocae, Cluj-Napoca.
10. Martinovici, C. (1921). *Dicționarul Transilvaniei, Banatului și celorlalte ținuturi alipite*, Institutul de Arte Grafice Ardealul, Cluj.
11. Pașcu, Șt. (1971-1989). *Voievodatul Transilvaniei*, Edit. Dacia, Cluj-Napoca.
12. Pop, I.A., Nägler, Th., Magyari, A. (coord.) (2009). *Istoria Transilvaniei*, Academia Română, Centrul de Studii Transilvane, Cluj-Napoca, vol. I.

13. Pop, I.A., Nägler, Th., Magyari, A. (coord.) (2007). *Istoria Transilvaniei*, Academia Română, Centrul de Studii Transilvane, Cluj-Napoca, vol. II.
14. Pop, I.A., Bolovan, I. (2013). *Istoria Transilvaniei,* Academia Română, Centrul de Studii Transilvane, Cluj-Napoca.
15. Rogoz, V. (2002). *Familia în credințe, rituri și obiceiuri: studiu de etnologie aplicată pe un material din Țінutul Codrului,* Series ethnologica, Edit. Solstițiu, ediția a II-a (revăzută), Satu Mare.
16. Rotariu, T., Semeniuc, Maria, Mezei, E. (2004). *Recensământul din 1850*, Transilvania, Presa Universitară Clujeană, Cluj-Napoca.
17. Rotariu, T., Semeniuc, Maria, Mezei, E. (1996). *Recenământul din 1857,* Transilvania, Presa Universitară Clujeană, Cluj-Napoca.
18. Rotariu, T., Semeniuc, Maria, Mezei, E. (2008). *Recensământul din 1869*, Transilvania, Presa Universitară Clujeană, Cluj-Napoca.
19. Săgeată, R. (2013). *Organizarea administrativ teritorială a României. Evoluție. Propuneri de optimizare*, www.geopolitic.ro.
20. Suciu, C. (1966). *Dicționar istoric al localităților din Transilvania*, Edit. Academiei Republicii Socialiste România, Bucharest.

STUDIA UBB GEOGRAPHIA, LXII, 1, 2017 (p. 105-124)
(RECOMMENDED CITATION)
DOI:10.24193/subbgeogr.2017.1.08

THE NATURAL ENVIRONMENT AND TOURISM POTENTIAL OF IARA-HĂŞDATE BASIN

C. MOLDOVAN[1], ŞT. DEZSI[1], R. RUSU[1], T. MAN[1], E. B. DOLEAN[1]

ABSTRACT. – The Natural Environment and Tourism Potential of Iara-Hăşdate Basin. Analzyed mainly from a natural perspective, the tourism potential of the area shows important characteristics providing favourable premises for tourism planning and development. The morphological, climatic bioclimatic, hydrological and biogeographical features of Iara-Hăşdate Basin are investigated in order to create a detailed inventory of the natural resources with a specific tourism potential and to identify different types and forms of tourism which can be developed.

Keywords: *Iara-Hăşdate Basin, natural and anthropogenic tourism potential, gorges, defiles, cliffs.*

1. INTRODUCTION. GENERAL GEOGRAPHICAL AND TOURISM FEATURES

The area of study is located in the central and southern part of Cluj County and corresponds mainly to Iara-Hăşdate Basin, Săvădisla – Luna de Sus Corridor and the mountain and hilly areas that border them on the periphery, completely integrating 6 administrative units (Băişoara, Ciurila, Iara, Petreştii de Jos, Săvădisla and Tureni). Therefore, it is situated at the contact of two major geographical regions that have a complex and complementary geographical and tourism potential: Apuseni Mountains and the Transylvanian Basin.

The geographical location provides not only a privileged situation but also a relative geographical unity marked by a complex and complementary natural environment. The varied landscape is the result of the lithological, geological and hydrological evolution which structured a morphological setting made up

[1] *"Babeş-Bolyai" University, Faculty of Geography, 5-7 Clinicilor Street, Cluj-Napoca, Romania, e-mails: ciprian.moldovan@ubbcluj.ro, raularian.rusu@ubbcluj.ro, stefan.dezsi@ubbcluj.ro, titus.man@ubbcluj.ro, dolean_eugen@yahoo.com*

by a number of marginal mountain and hilly units: Feleacu Range, Săndulești and Petrești Ranges belonging to Trascău Mountains, Muntele Mare and Gilău Mountains, mountain basins and valley corridors (Pop, 2012, p. 101).

The whole area ranges in altitude from 1826 m in Muntele Mare Peak, on the limits of the study area, to 281 m in the lowest point of the region. The difference in height and the high fragmentation of the area due to the drainage network (Hășdate, Iara and Feneş rivers and their tributaries) determined implicitly a peculiar landscape diversity (Pop, 2012, p. 102). Even more, all these impacted in a specific manner on the climatic and bioclimatic features, the hydrological component and, not in the least, on the biogeographical range. Each of them may provide proper attractive resources but they are also auxiliary factors in promoting the features of the others as the favorable aspects derived from the cooperation of the parts are attached to the individual contribution of each, therefore outlining a complex, diverse and attractive natural environment.

The marginal mountain natural units surround a corridor, a geographical component that provided optimal habitat conditions and allowed the development of a system of rural settlements that have a specific personality. Its emergence and development was favored by a high communication potential and diverse complementary resources.

The area of study favored an intense, continuous and ancient habitation, proved by archaeological data from prehistoric, Dacian and Roman sites and continued in specific historical condition throughout the Middle Ages and the modern era.

The anthropogenic component was also constituted or completed throughout the ages in a positive manner by foreign communities, especially the Hungarian ones, colonized in this area since the 12th century, especially in the villages Săvădisla, Vlaha and Liteni. The Hungarians have had a specific impact on the habitat, the land use and, not least, the mentality.

All these led to the individualization of a true human settlement subsystem, made up by areas of ancient and intense habitation which were geographically and administratively an integral part of the county specific structures. The intense and continuous habitation led to the development, in time, of a system of rural settlements that have a specific physiognomy, usually respecting the general regional specificity without excluding interferences proper to the national communities inhabiting the analyzed territory. The activities have been adapted to the natural conditions, leading to a rural civilization that has a certain specificity. Within this civilization and for each geographical component, conditions have been created to develop a complex tourism that has peculiar characteristics, complementing the types and forms of classical tourism related to the usual tourism supply in the rural space and to the capitalization of morphological, landscape and climatic resources in the surrounding mountains.

Thus, from the point of view of tourism, the analyzed area has got enough arguments for the integration in the regional and national tourism but also for the involvement in the international, global or European tourism and the attraction of tourism flows from neighbouring countries (especially Hungary), from other European countries or from around the world.

The analyzed territory is located between two major axes of communication that border it in the North (DN 1 or E 60) and in the South (DN 75) and is crossed on SE-NW direction by Transylvania motorway. The main road of the area links all these roads and provides a good accessibility to the tourist attractions.

At the same time, the location of most of the settlements along the two main valleys that drain the basin (Hășdate and Iara, tributaries of Arieș River) and Săvădisla-Luna de Sus Corridor (Feneș Valley, a tributary of Someșul Mic River), along their tributaries, at their confluence or along roads linking them, allowed the development of junction settlements that provide the link to the marginal villages and a main axis along the road between the two mentioned national roads, as well as secondary axes along the tributaries or between them, that have an important impact on territorial organization and the every day life in the region.

The nearby presence of important urban centers like Cluj-Napoca, Turda and Câmpia Turzii played a major part in the highlighting and individualization of the entire analyzed space in relation to the similar regional units in terms of functions and size. The location of the area at the junction or along the roads connecting trade centers and regions (Transylvania and Crișana) has been a competitive advantage capitalized ever since the Middle Ages. The further social, economic and political evolutions enabled the analyzed territory to increase its importance at regional and national level.

In this context, one should note the presence of **a relatively complex natural and anthropogenic tourism potential**, which constitutes a *premise, a fundamental factor for tourism development and primary tourism supply* (which individualizes the area within Cluj County).

2. THE TOURISM POTENTIAL OF THE NATURAL ENVIRONMENT

The natural component of the tourism potential as a whole and across its components exerts an attraction for various categories of effective and potential tourists, providing favorable premises for the development of different types and forms of tourism. According to the natural environment component that is dominant, one remarks characteristic tendencies towards adapted ways of tourism planning taking into account the differentiated capitalization of the primary tourism supply.

The natural heritage is dominant due to its components in the mountain sector of the region, covering large areas in Muntele Mare Range, Gilău Mountains and the northern parts of Trascău Mountains (Sănduleşti/Petreşti Range), as well as in Feleacu Range.

2.1. The tourism potential of the landforms (morphological tourism potential) is important mainly for the landscape. The variety and its attractive potential is tightly linked to the structure, lithology, tectonics and the impact of the external modeling factors which determine by altitude the zoning and variety of other physical-geographical components, related to climate, vegetation, fauna and soils.

The morphological and landscape component is vertically displayed on altitude levels and follows the general lines of the mountain ranges which border the region marginally in the West (Gilău Mountains), South-West (Muntele Mare Range), South (Trascău Mountains) and East (Feleacu Range). The altitude drops usually from West to East (Pop, 2012, p. 101).

There are therefore ***mountain ranges, basins and valley corridors*** which contribute to the individualization of the region and set up a specific physiognomy, like an amphitheater, for the entire analyzed space, providing the aspect of "natural fortress". As a consequence, there are varied morphological conditions, including steeper or gently rolling slopes, higher or lower landforms, different aspects, continuing towards the basins and corridors with glacises of different size and fragmentation, clearly outlining the watersheds, basins and valley corridors.

From this point of view, one should remark first the marginal mountain units: Gilău Mountains in the West, Muntele Mare Range in South-West, Trascău Mountains in the South and Feleac Range in North-East. There is a sharp morphological and altitudinal contrast between these mountain landforms and the basins and corridors included in the analyzed region or beyond it, as for instance the Transylvanian Plain to the East. There is a large variety of landforms belonging to several morphological units (from 281 m in the lowest point of the region to 1826 m high in Muntele Mare Peak) that have a complex structure and a varied and long geological past and an important impact on all natural components, due to the value and diversity of tourist attractions.

2.1.1. Gilău – Muntele Mare Mountains are one of the highest ranges of Apuseni Mountains, second only to Bihor-Vlădeasa Mountains. They are located in the North-East of Apuseni Mountains, to the West of Hășdate-Iara Basin and Săvădisla – Luna de Sus Corridor. Huedin Basin delineates them to the North while in the South they reach the valley of Arieș River. To the West, they continue with Bătrâna and Vlădeasa Mountains. The part included in the analyzed territory is drained by a series of left tributaries of Arieș River (Iara, Hășdate and Poșaga) and a right tributary of Someșul Mic (Feneș Valley) (Pop, 2006, p. 179).

They are made of crystalline schists and granite intrusions which are present in the center in the shape of the letter "L". There are also Cretaceous sedimentary rocks in the South, covering smaller areas, where valleys strongly deepened (Pop, 2006, p. 179).

Generally, the landscape is characterized by the high frequency of rounded ranges and flat areas – Fărcaş-Cârligatele, Măguri-Mărişel and Feneş-Deva erosion surfaces, bordered by steep slopes that come down for long distances towards the low valleys (Pop, 2006, p. 179).

Several areas of different sizes within the two ranges are characterized by the dominant presence of the limestones which allowed the development of varied karst landforms, of which the gorges are the most representative ones (Pop, 2006, p. 179).

The natural forest vegetation lays on several altitudinal levels and is made of spruce and fir trees in the upper parts, followed at lower altitude by deciduous species (beech, then oak). It was systematically subjected to intense human intervention, especially in Gilău Mountains, where forests were cut on large areas and later replaced by secondary grasslands and hay fields, as well as scattered settlements (such as Mărișel and Măguri). However, in Muntele Mare Range, there was a "swarming" process of the population towards the higher lands for sheep husbandry, which led to the creation of new settlements formed by people who owned parts of the mountains (for instance: Muntele Filii, Muntele Băişorii, Muntele Cacovei etc) (Pop, 2006, p. 179).

2.1.2. Trascău Mountains began in the north-eastern part of the analyzed region, on Tureni Valley, and reach the south-eastern part of the region, on Arieș Valley, which forms an attractive narrow sector between the mountains on the territory of Lungești and Buru villages. North of Arieș, Trascău Mountains are present by means of a Mesozoic limestone ridge, clearly standing out, crossed by Hășdate and Tureni valleys which form the spectacular Turda and Tureni gorges (Pop, 2006, p. 194).

In the immediate neighborhood of the area, within the same mountain unit, there are several surface and underground karst formations having a high aesthetic and landscape value: limestone pavements (Colţii Trascăului, Bedeleu, Râmeţ and Ciumerna Ranges), isolated cliffs (Pleașa Râmeţului, Piatra Grohotișului) and peaks (Piatra Cetii, Piatra Craivii). One should add dolines, lapies fields, caves (Huda lui Papară, 2 km long). Due to the steep slopes, the intense disintegrating processes determine the creation of expressive scree fans (Pop, 2006, p. 194).

The drainage network has generally a transverse character and a dominant direction North-West – South-East. The most important valleys are Tureni, Hășdate, Iara and Ocolișel. In their lower sectors, before their confluence with Arieș River, they cross the harder rocks of Sănduleşti Ridge (Jurassic limestones and ophiolites) and Petreşti Ridge (crystalline schists), in which the valleys deepen forming the gorges of Tureni, Turda (between Petreştii de Jos and Cheia), Iara or Surduc Defile (between Surduc and Buru) (Pop, 2006, p. 195).

Within this mountain unit, the forests were also largely cut to make way for secondary grasslands and hay fields. Few compact forests remain, mainly on the slopes. The dominating species is the beech, while the fir tree is seldom found because of the lower altitudes (the highest peaks do not exceed 1300 m) and foehn winds, which make the oak to climb as high as 700m. Near the analyzed area, on the territory of Vidolm village, there is a compact forest of European larch (*Larix decidua*) (Pop, 2006, p. 195).

Among the composing elements that store higher attractive values, one lists the *peaks, landforms created by differentiated erosion, gorges and defiles, scarps and some landforms belonging to karst morphology (especially caves)*. They can all be destinations for an established mountain tourism.

2.1.3. Gorges and defiles that have an attractive potential

They represent landforms well known for their picturesqueness and spectacularity. They attract tourists because several attractive elements are grouped together and concentrated in their perimeter: cliffs, caves, ridges, waterfalls, meanders etc.

In the eastern, south-eastern and southern part of the analyzed region, the extension of Trascău Mountains (made up predominantly of Jurassic limestones) North of Arieș River favored the development of a specific morphology of gorges and defiles. The most representative are (*Planul de dezvoltare a județului Cluj*, 2005, p. 33):

- *Arieș Defile*, between Buru and Moldovenești, about 3 km long;
- *Turda Gorges* (2,9 km long and covering 324 ha). They have been dug by Hășdate River and have a strong vertical development (slopes and vertical cliffs as high as 300 m), residual landforms, caves (Cetăţeaua Mare and Cetățeaua Mică). It is also a nature reserve including more than 1000 rare plant species, some of them under protection (buttercup, valerian, monk's hood, iris, mouse-ear hawkweed, silver service tree, wild garlic etc.) and 67 species of birds (golden eagle), fish, batrachians, foxes, weasel, marten, wild boar, deer, snakes etc.

- *Tureni Gorges*, located near Turda Gorges, dug by Racilor (Tur or Tureni) Valley for 1.85 km. They are among the wildest gorges in Trascău Mountains, having steep high cliffs (100-150 m) and diverse forms and microforms specific for karst morphology: rapids and small waterfalls in the riverbed (up to 3 m high), and large waterholes, called "bolboane" (for example, "Bolboana Fetelor" – Girls' Whirlpool, "Bolboana Șerpilor" – Snakes' Whirlpool).

On the slopes there are 29 caves, such as Peștera cu Silex (Silex Cave, 64 m long), Peștera de sub grohotiș (Cave under the Scree, 27.5 m), Peștera Vulturilor (Eagles' Cave). One remarks Peștera Șura Mare (Big Barn Cave) because of its large entrance portal. Apart from these, there are also other attractive landforms and cliffs, such as Colțul Câinilor (Dogs' Corner) and Stâna Crinilor (Lilies' Fold), as well as 53 traces of settlements dating since the Middle Neolithic (*Strategia de dezvoltare a județului Cluj*, 2011).

The nature reserve was declared a "protected area" by Law no. 5 of 6 March 2000 regarding the approval of the National Master Plan – Section III – Protected Areas and it is also a Site of Community Importance (SCI). Across the reserve, there are three types of natural habitats of community interest: rupicolous calcareous communities or basophilic grasslands of the *Alysso-Sedionalbi*; subcontinental peri-Pannonic scrub; and calcareous rocky slopes with chasmophytic vegetation. They shelter diverse flora and fauna species, some of them protected at European level or even included on the IUCN red list (*Planul de dezvoltare a județului Cluj*, 2005, p. 30).

Among the plant species that occur within this nature reserve, one should mention the rowan (*Sorbus dacica*), Greek whitebeam (*Sorbus graeca*), germander meadowsweet (*Spiraea chamaedryfolia*), birthwort (*Aristolochia clematitis*), dandelion (*Taraxacum hoppeanum*), centaury (*Centaurea atropurpurea*), nailwort (*Paronychia cephalotes*), Transylvanian violet (*Viola jooi*), fragrant yellow onion (*Allium flavum*), bur medick (*Medicago minima*), mountain houseleek (*Sempervivum marmoreum*), Spanish catchfly (*Silene otites*), scalloped spirea (*Spiraea crenata*), thyme (*Thymus comosus*), basket of gold (*Aurinia saxatilis*) and barren strawberry (*Waldsteinia geoides*) (*Planul de dezvoltare a județului Cluj*, 2005, p. 27).

The fauna is represented by several species of amphibians, fish and insects, such as yellow-bellied toad (*Bombina variegata*), European fire-bellied toad (*Bombina bombina*), Transylvanian smooth newt (*Lissotriton vulgaris ampelensis*), spined loach (*Cobitis taenia*), and three butterflies: Jersey tiger (*Callimorpha quadripunctaria*), scarce fritillary (*Euphydryas maturna*) and Fenton's wood white (*Leptidea morsei*) (*Planul de dezvoltare a județului Cluj*, 2005, p. 28).

Apart from these gorges, there are several sectors of spectacular gorges, located in Petreşti Ridge (also belonging to Trascău Mountains): Borzeşti Gorges (0.4 km) and Hăşdate Defile (1 km). The longer Iara or Surduc Defile (3 km) is situated in Gilău-Muntele Mare Mountains (*Planul de dezvoltare a judeţului Cluj*, 2005, p. 6).

2.1.4. Cliffs are very spectacular landforms, resulted from the fast deepening of valleys especially in limestone geological structures.

They attract tourists because of their vertical extension, their grandness and spectacularity, and the landscape contrast they provide if compared to the neighboring areas.

Such forms are to be found first of all in certain sectors of Surduc Defile and Ocolişel Gorges but especially within Tureni and Turda Gorges, where the height of the cliffs may reach or exceed 250 m. The very diverse detailed morphology (overhangs, cracks, gullets, scree corridors, ridges and headlands) have an aesthetic value and a visual impact creating a very attractive landscape.

Cliffs are not only attractive to tourists who are content to appreciate them from a certain distance, but they also address to a special category of tourists who are initiated in the practice of a specific form of recreational adventure tourism – mountain climbing, strictly conditioned by the presence of cliffs.

Due to their specificity, it is needed that the cliffs used for climbing to be appropriately equipped in order to be accessible.

Unfortunately, because of the high costs, the proper equipment actions take place only in the case of cliffs within the two mentioned areas. For instance, in Turda Gorges, there are 25 high difficulty climbing routes, graded between IV and VI: one route graded 6A, two graded 5B, six graded 5A, 9 graded 4B and 7 graded 4A. There are lots of other routes, less difficult, graded II or III, recommended for beginners in climbing (*Planul de dezvoltare a judeţului Cluj*, 2005, p. 7). In the future, by means of proper arrangement, this type of active tourism can be extended to the other cliffs of the nearby gorges that are favourable for the practice of sport climbing.

Gilău and Muntele Mare Mountains are mainly made up by crystalline schists with intrusions of granite and are mostly fragmented by Iara Valley and its tributaries, which determine a predominant North and North-West slope aspect. Rounded tops and summits are the dominant features, along with flat or slightly undulated surfaces, from which slopes descend fast and sometimes steep towards the deep valleys. The slopes are not steep enough for climbing but they are favourable for the practice of winter sports. For example, at the foot of Buscat Mountain, there are such features, and the necessary conditions in terms of length, slope and aspect are met, therefore the area has been developed, giving birth to the already famous ski area of Băişoara and the recently opened Buscat Mountain ski complex.

2.1.5. The speleological potential of the area is provided by the presence of several underground caves, concentrated especially in the area of Tureni Gorges (29) and Turda Gorges.

In *Turda Gorges*, there are about 50-60 caves, arcades (remains of the collapsed caves) or niches. Most caves are very small, only eight of them exceed 20 m in length, and the largest one reaches 123 m. The most important ones are "Cetăţeaua Mare" Cave or Balica's Cave, located near bridge no. 4, on the right side of Hăşdate Valley. This is where an outlaw from Petreştii de Jos, Nichita Balica, used to hide. He took part in the kuruc rebellion against the Habsburgs in early 18th century.

There are 29 caves in the cliffs of *Tureni Gorges*, such as Peştera cu Silex (Silex Cave, 64 m long), Peştera de sub grohotiş (Cave under the Scree, 27.5 m), Peştera Vulturilor (Eagles' Cave). One remarks Peştera Şura Mare (Big Barn Cave) because of its large entrance portal (*Planul de dezvoltare a judeţului Cluj*, 2005, p. 9).

Table 1. The main potentially attractive underground caves in the studied area

No.	**Name of the cave**	**Mountain range**	**Attractive potential**					**Location potential**	**Difficulty grade**
			Cave	**Speleo-themes**	**Lakes, rapids**	**Fossil ice**	**Paleonto-logical or archaeo-logical remains**		
1	P. de sub Creastă	Trascău	x					++	II
2	Peştera Cetăţeaua	Trascău	x				x	++	I

xxx –high attractive potential
xx - average attractive potential
x - limited attractive potential

+++ - favorable location potential
++ - satisfying location potential
\+ - unfavourable location potential

Source: P. Cocean (1995), p. 56-67

2.2. Climatic and bioclimatic potential

Due to its geographical position, the studied area has a moderate continental climate, characteristic for the western and north-western parts of Romania, and a predominant western circulation. As a consequence, maritime polar or maritime arctic air mass invasions from North-West are dominant in winter while warm air masses from the South-West are specific for summer, as part of the north- Mediterranean cyclonic activity moving northwards.

The characteristic climate of the reference area is the one for hilly regions and mountain basins at heights between 250 and 800 m. It is favorable for all categories of people because it is a sedative-indifferent sparing bioclimate. The climatic elements and bioclimatic indices are relatively moderate throughout the whole year, less stimulant or nonstimulant for the human organism that does not have to make any special efforts for adaptation and acclimatization. It is considered an ideal bioclimate, without any therapeutical contraindication in all seasons. The marginal western and southern sectors, corresponding to Gilău - Muntele Mare and Trascău mountain ranges, are characterized by the presence of a mountain stimulant tonic bioclimate, that appeals more to the neurovegetative and endocrine functions which coordinate and determine the acclimatization of the human body to specific environmental conditions (*Planul de dezvoltare a județului Cluj*, 2005, p. 21-22). This type of climate is also significantly influenced by the predominantly western and north-western circulation.

In this context, the main elements which define the study area specific bioclimate have the following features.

2.2.1. Air temperature. The annual average temperature values are favorable for tourism: Turda 8.4°C and Cluj-Napoca 8.2°C. In all months of summer, average temperatures are above 17°C in the hilly areas. The highest average temperature values are recorded in Cluj-Napoca (18.9°C).

Because of the high morphological fragmentation, there are topoclimatic peculiarities in each of the two main landforms – the mountains and the basins and corridors. The annual average temperatures are around 1.5-2.5°C on the tops of Muntele Mare Mountains, 3-6°C at the periphery of the mountains (Băișoara 4.2°C) and 7-9°C in the hilly areas and in the basins and corridors (Turda 8.4°C) (*Planul de dezvoltare a județului Cluj*, 2005, p. 23).

In winter, in anticyclonic conditions, there are frequent *temperature inversions*, which favour the emergence of hoarfrost, fog and stratiform clouds in the lower areas, meteorological elements that have a negative impact on tourism.

2.2.2. The amount of rainfall, considered as a decisive factor during the warm season, is characterized by the increase of annual average amounts of precipitation from the North-East to West and South-West, according to altitude and exposure to Western circulation.

There are high annual average amounts of precipitation, increasing from 600-700 mm annually in the basins and along the corridors up to more than 1000 mm annually or even 1200-1400 mm annually on the highest tops in the mountains (*Planul de dezvoltare a județului Cluj*, 2005, p. 21-22). There is also a high relative air humidity throughout the year leading to a decrease by 2-3°C of the temperature felt by the human body compared to the real temperature and results in the offset of phenological stages by 2-3 weeks compared to the areas outside the basins.

The lowest average annual amount of precipitation is recorded in Turda – Câmpia Turzii Basin, which is in the shadow of western winds bringing precipitation, and also a consequence of the foehn circulation in this region.

The month that has the lowest average amount of precipitation is February: 19.8 mm at Câmpia Turzii and 32.8 mm at Băişoara. In average, snow begins to fall in October in the mountain areas and in the second decade of November in the hilly areas. The average day of the last snow is 30 March in the hilly areas and 20 April in the high mountains (*Planul de dezvoltare a judeţului Cluj*, 2005, p. 25). Therefore the cold season is about 5 months long in the mountains, where there is snow cover long enough for the practice of *winter sports and the associated types of tourism*.

2.2.3. Nebulosity presents different values for each of the mentioned areas, according to the landforms and the atmospheric circulation. The annual average values exceed 6/10 in Băişoara area, where the average annual number of clear days is 80, and drops to 5/10 in the Transylvanian Plain, where there are 110-120 clear days annually on average. There are about 124-150 overcast days annually in the basins and between 160 and 190 overcast days annually in the mountains (*Planul de dezvoltare a judeţului Cluj*, 2005, p. 23, 25).

All these elements are involved in the setting of bioclimatic indices, whose values are reflected in the degree of favorability or restrictiveness in the practice of outdoor tourism activities, especially air therapy and heliotherapy.

2.2.4. The climatic tourism index (I) has average-high values, which means that there are favorable conditions for the development of tourism activities. The index is calculated as $I = S+T-5D/5$, where I – the climatic tourism index; S – the duration of sunshine; T – average temperature; D – duration of daily precipitation in hours (if one takes into account that 1 hour of sunshine is the equivalent of 4 hours of rain) (Fărcaş et al., 1968).

The major configuration of the landforms, the detailed morphology and the vegetation cover are elements that influence and diversifies the climate, contributing to its impact on the human body. The climatic factors that have a bioclimatic impact (temperature, precipitation, humidity, winds, duration of sunshine, air composition, solar radiations etc.) have also an influence on leisure activities, the practice of season-specific sports, the treatment of different diseases. They all depend on the relation between the human organism and the bioclimate. The climatic therapy takes into account both temperature and hydrological factors. For *air therapy* as a type of cure by means of direct contact between the body and the atmosphere, one has to consider the temperature factor and air ionization (*Planul de dezvoltare a judeţului Cluj*, 2005, p. 21).

2.2.5. The thermal comfort is related to the capacity of the human body to maintain a constant temperature within the large limits of the environmental temperature. Homeothermy is made by transfer or accumulation of heat according to the environmental temperature. There is a neutral zone in terms of temperature which creates the sensation of thermal comfort for the human body, between 16.8 and 20.9°C (equivalent effective temperature). Under 16.8 there is a discomfort due to cooling and above 20.9 the discomfort due to warming. In the basin area and up to 600-700 m, there are more than 10 days of thermal comfort annually; while at altitudes of more than 1500 m a person in recess does not feel the sensation of thermal comfort (*Planul de dezvoltare a județului Cluj*, 2005, p. 21).

The thermal discomfort due to warming has an average duration of 5 days annually at altitudes between 500 and 900 m. Over 900 m, there is no such discomfort. The thermal discomfort due to cooling has an average duration of 5 days annually at 500 m of altitude, 10 days annually between 500 and 1000 m and 15 days between 1000 and 1500 m (*Planul de dezvoltare a județului Cluj*, 2005, p. 21).

As a result, *the number of days with thermal comfort,* when the human body is recess and has light clothes, and does not need to transfer or to accumulate heat, exceeds 10 days in July on average in the hilly area. This value is similar to that of other parts of the Transylvanian Plateau, the Moldavian Plateau or the Subcarpathians. This relatively unfavorable situation is due to the rather high number of days with *thermal discomfort* because of the heating – about 5 days in the basin area due to insolation but completely missing in the high mountains. The low values in the basin areas are the result of the sheltering position provided by the surrounding mountain ranges and the relatively high forest cover within the region. There are also about 5 days of thermal discomfort due to cooling in winter (*Planul de dezvoltare a județului Cluj*, 2005, p. 21).

2.2.6. Bioclimatic stress is determined by the simultaneous impact of the climatic factors – temperature, humidity, wind – on the human body, especially on the skin and the respiratory system. In the specific conditions of the study area, the registered values are between 10 and 20. The months of November, December, January, February and March are usually hypertonic, while May, June, July, August and September are usually hypotonic. There are only two relaxing months of transition, April and October (Teodoreanu, 1984).

Pulmonary stress is produced as a result of respiratory transfer. The hydric discomfort in summer shows that the air is saturated by water vapours while the desiccant discomfort in winter demonstrates a low amount of vapors in the air. The values in the basin area are low (20-30) (*Planul de dezvoltare a județului Cluj*, 2005, p. 22).

As a result, in the basin area, the months of December, January, February and March are desiccant, while May, June, July, August and September are hydrating. This time, three transition months have balanced values: April, October and November.

The accumulation of the two categories of stress, bioclimatic stress and pulmonary stress, leads to the definition of total bioclimatic stress. Its values are under 40 in the basin area, which makes it a sort of a "bioclimatic island" surrounded by the marginal mountain ranges (*Planul de dezvoltare a județului Cluj*, 2005, p. 22).

2.2.7. Snow cover is another important climatic component that has a high impact in mountain tourism. Its characteristics – duration, depth, consistency and stability – are differentiated according to the altitude in the mountain areas and the slope aspect. When there are normal amounts of snowfall in winter, the snow cover provides the opportunity for practicing winter sports and for the complex development of ski tracks and mountain resorts for winter sports, extended over variable areas, up to the highest mountain altitudes.

There are natural morphoclimatic conditions in the mountain region included in the analyzed space that meet the conditions for this type of tourism in several locations that might be integrated in the future supply if properly developed.

Thus, the complex analysis of the mountain ranges included in the analyzed region allowed the identification of an area around Buscat Mountain, close to Băișoara resort, which is adequate for the development of facilities for the practice of winter sports, mainly ski, as they meet the essential natural conditions that are necessary in this respect. In this area, there is an optimal combination of morphoclimatic elements – topographic factors (altitude, morphological configuration, slope aspect, morphometric features), climatic elements (snow cover duration and depth, air temperature and winds) – and the favorable location in relation to the main potential areas of origin for the customers and the degree of accessibility.

2.3. The hydrogeographical tourism potential is represented by the water categories that exist in the analyzed region.

2.3.1. The surface hydrogeographical tourism potential is relatively diverse and has a strong direct impact. The location and the dynamic and morphometric features of surface waters determine the residential, demographic and economic development of the entire analyzed space.

The drainage network crossing the reference territory takes part in the development or emergence of tourism activities in manners that come out from the margin effects revealed, the facilities for leisure (pick-nick) or fishing provided by some sectors and the landscape diversification of recreational areas.

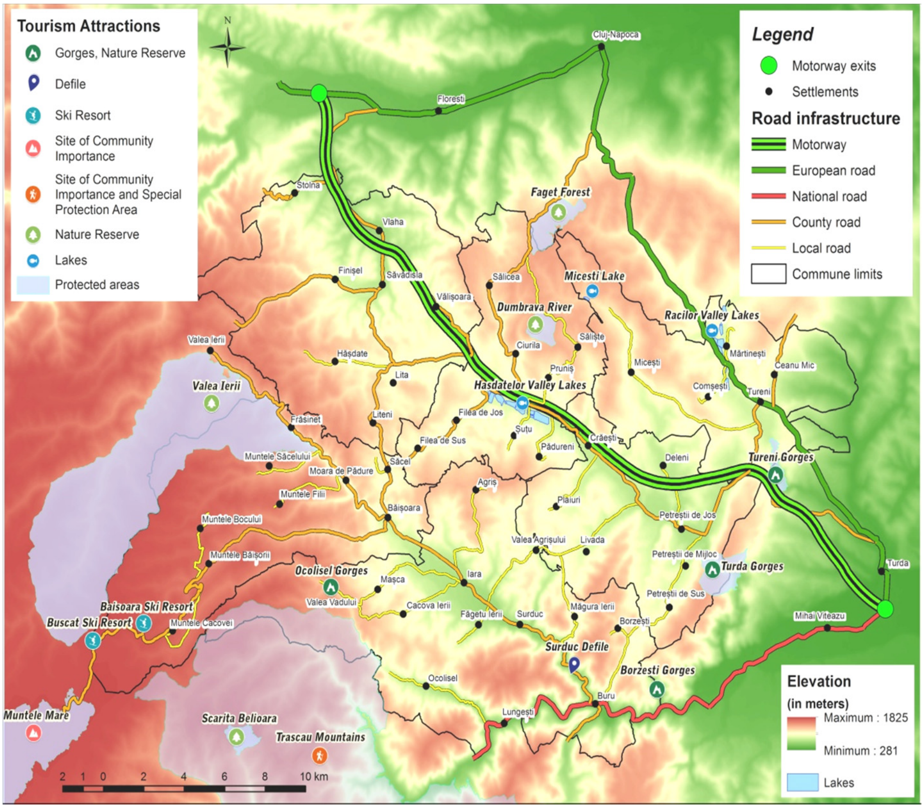


Fig. 1. Main tourism attractions in Iara-Hășdate Basin and its surroundings

The physiognomy of the river banks (such as the detailed configuration and morphology, which is different according to the lithological structure, the landforms crossed and so on) plays a major part in attracting tourists, while the tourists' typology imposes the type of practiced tourism. For leisure tourism, forested banks are preferred (as they determine a margin effect), as well as less fragmented banks and an extended riverbed.

Iara and Hășdate are the rivers that have such sectors, proper for the development of the above-mentioned activities in the shape of short-period (mainly week-end) tourism.

However, on the whole, the tourism impact of streams is rather low, including the margin effect produced, not too much capitalized by the short-period tourism. This is due to the low discharge and depth of the rivers which do not allow the presence of sectors proper for the development of organized or spontaneous leisure tourism activities, like swimming or nautical sports.

2.3.2. The lakes are important both for their aesthetic and landscape value and for fishing.

The construction of dams led to the emergence of *man-made reservoirs* which have different sizes, shapes and functions. They have a favorable location in an area that has morphological, environmental and landscape values given the variety of landforms and the forest vegetation nearby. These lead to a significant individualization of the lakes in the landscape and enhance their attractiveness.

The artificial dam lakes (reservoirs) are proper tourist attractions because they may be used for leisure, boating, fishing or recreation. They are also elements that diversify the physiognomy of the landscape and reveal a complex margin effect, capitalized by means of recreational tourism. Therefore, the shores of the lakes concentrate a high number of tourists, especially during the warm season (*Planul de dezvoltare a județului Cluj*, 2005, p. 20).

The most important reservoirs are located along Racilor Valley near Mărtinești and Tureni, at about 20 km from Cluj-Napoca on the national road DN 1 (European road E 60/E 81). They cover approximately 35 ha and are the property of Sunfish SRL. The main fish species to be found are: common carp (*Cyprinus carpio*), silver carp (*Hypophthalmichthys molitrix*), grass carp (*Ctenopharingodon idella*), zander (*Sander lucioperca*), crucian carp (*Carassius carassius*), bream (*Abramis brama*), rudd (*Scardinius erythrophthalmus*).

Similar fish species can be found in the five reservoirs along Hășdate Valley, located downstream from Lita, near the villages of Șutu and Pădureni.

2.4. The biogeographical tourism potential

2.4.1. The vegetation cover is very diverse and is made up by many associations and communities, which leads to high landscape diversity.

In this respect, from the point of view of tourism, *the forest* is the most important and complex natural ecosystem. It has a different vertical development depending on the age, it is perennial and its physiognomy is provided by the species composition and the spatial extension. It covers large areas, especially in the marginal mountain areas, but also in the basins and along the corridors.

The forest ecosystem is strictly related to the other components of the environment, especially the landforms and the climate, in terms of spatial distribution and the diversity of plant species. The altitude determines a certain zoning, and each zone covers about 300-500 m in height and contains specific vegetation associations.

The forest zones are vertically distributed from about 300 m to more than 1500 m. In the lower areas, deciduous forests are characteristic. They are made of sessile oak (*Quercus petraea*) in association with hornbeam (*Carpinus betulus*) or beech (*Fagus sylvatica*) in association with hornbeam (*Carpinus betulus*), especially on less frgamented terrain, at altitudes between 300 and 650 m. Higher than that, one usually finds beech forests up to 1000 m, where the beech is already mixing with coniferous species like fir trees (*Abies alba*) and spruce (*Picea abies*). Above 1200 m, one finds the boreal forests made up of coniferous species, predominantly fir trees and spruce.

The mixed forests including species belonging to *Quercus* and other deciduous species cover smaller areas. They are characteristic for watersheds between 400 and 500 m and the dominant species is usually the sessile oak (*Quercus petraea*). In the alpine area, above 1650 m, the common chrystalline schists morphological landscape is harmoniously completed with subalpine scrub and the herbaceous alpine vegetation creating vast meadows. During the flowering period, the varied chromaticism provided by the blossoming plants becomes part of the specific landscape of the upper mountain areas (Pop, 2006, p. 147-148).

Each of the zones consists of a diversity of species, which differentiate their appearance in each season. Between forestry zones, there are contact areas made up by a mixture of species belonging to both the upper and lower zones. They lead to an even higher physiognomic and landscape diversity.

This situation leads to the establishment of a tourist function for the forest vegetation. The forests also constitute areas of calmness, where pollution is absent or reduced, and it becomes a destination for people escaping the urban space, but not only. The forest is thus attractive and is used for leisure, recreation and entertainment, by means of different activities: observation of nature, photography, landscape contemplation, walks, hunting, fishing, phytotherapy, gastronomy, other traditional activities. In the forest, one combines the characteristics of leisure tourism with curative and sporting tourism.

From the point of view of forestry planning and management, the considered territory, delineated according to local government boundaries, corresponds to the territory of several forestry units, under the jurisdiction of Cluj Forestry Department: Turda Forestry Unit – which includes most of the analyzed area, Gilău Forestry Unit and Cluj-Napoca Forestry Unit (*Planul de dezvoltare a județului Cluj*, 2005, p. 25-26).

The compact forest landscape is supplemented by the forestry vegetation made up by isolated trees or clumps of trees, dispersed within the forestry units. They have an "*island effect*", which is very important in tourism because of the physiognomic and structural contrast specific for the contact area between forests and hay fields or natural meadows. The glades or openings in the forest reveal a similar aspect of the "island effect" as they often break the monotonous forest landscape.

Unfortunately, the vast majority of the forests in the research area are not integrated in the national tourism flows as stand-alone components, meant to have an exclusive tourism function. Because they do not have the status of forests used for leisure, recreation and sanitary protection, they are included in the economic circuits. Therefore, they provide wood for industrial use or for heating the dwellings in the villages that are not yet connected to the natural gas network.

As a result, the forests induce a minor social impact. The margin and island effects associated with the forests are less known and consequently are not capitalized by means of recreational and leisure activities during summer.

2.4.2. The faunistic component is an element that plays a part in making the territory more diverse and attractive. In the context of this analysis, it is important to note the presence of species that raise a scientific, aesthetic and sporting interest (for hunting or fishing). The balance of such species is performed by a thorough control of the forestry and environmental authorities.

Like the vegetation, the fauna is also structured according to altitude, contributing to the individualization of biocenoses that have a significant role in maintaining the ecological and trophic balance. It also provides the means for practicing a more exclusive type of tourism – *cynegetic tourism* (hunting). It is practiced by a rather small number of people who usually have higher living standards. Because the proper conditions are met, the practice of hunting is possible, as well as the possibility to acquire important hunting trophies, much searched especially by foreign tourists.

The fauna of hunting interest in the analyzed area includes mostly (*Planul de dezvoltare a județului Cluj*, 2005, p. 28):

- Terrestrial species: brown bear (in the forests of Gilău and Muntele Mare mountain ranges); red deer (in Muntele Mare Range); roe deer (consistently present in all the forests in the area); wild boar (inhabiting the deciduous forests and sometimes even the coniferous forests), rabbits, squirrels. One may add also the carnivore species: lynx, wolves, foxes, wildcats, pine martens, beech martens, polecats etc.
- Ornithological species (birds): partridge, quails, pheasants;
- Aquatic species of interest for fishing.

Hunting areas have been established in order to protect and preserve the endangered cynegetic species, to control hunting and to facilitate cynegetic tourism, by breeding and locating the game, building and maintaining the hunting infrastructure – lodges, watching huts, feeders, observation points, hunting trails.

For a better management, the territory has been divided into several *hunting areas*. Most of them (12) are included in Turda Forestry Unit: Feleac, Turda, Moldoveneşti, Lita, Băişoara, Valea Ierii, Harcana, Ceanu Mare, Triteni, Luna, Călăraşi and Ceanu Mic. Hunting lodges are at Moldovenești, Lita and Valea Ierii, while huts at Feleacu. Cluj-Napoca Forestry Unit includes 13 hunting areas: Stolna, Feiurdeni, Chinteni, Baciu, Şard, Floreşti, Someşeni, Corpadea, Suatu, Frata, Vaida Cămăraş, Geaca, Cătina (*Planul de dezvoltare a județului Cluj*, 2005, p. 28). However, only few of them cover a small part of the analyzed territory.

The drainage network of the analyzed territory shelters a diverse range of *fish* which represent a valuable asset for the development of fishing.

The fishing of trout is specific in the mountain areas, belonging to Turda Forestry Unit, in areas such as the Upper Iara Valley, Middle Iara Valley, Vadului Valley, Bondureasa Valley and Calului Valley.

2.5. The landscape and scientific value of some of the morphological, hydrographical or biogeographical components and the need for their protection has led to the initiative to set preservation regimes for natural areas that have a higher degree of complexity. The need to preserve the natural environment and its components also has a major tourism impact, resulting in the individualization of several areas that are protected and have a national or local (county) importance.

The categories have been set at national level by means of the Emergency Decree no. 236/2000 regarding the regime of protected natural areas, published in the Official Bulletin no. 625 on December 4, 2000, annotated by Law no. 462 of July 2001, published in the Official Bulletin no. 433 on August 2, 2001. They have been established according to the purpose and type of management as: *scientific reserves, national parks, natural monuments, nature reserves, natural parks, biosphere reserves, internationally important wetlands, world heritage natural sites, special areas of conservation* and *special protection areas for birds*.

The management of natural protected areas of national importance is regulated by a special act: Law no. 5 of March 6, 2000, regarding the approval of the National Master Plan – Section III – Protected Areas.

According to the stipulations of the Emergency Decree no. 236/2000, annotated as Law 462/2001, article 5, annex 1, there are *nature reserves* in the analyzed territory.

In Cluj County there are 20 nature reserves of national importance, of which three are located in the study area (table 2).

Table 2. Protected areas of national importance in the analyzed region

Name of the protected area	**Location**	**Value**	**Category**
Tureni Gorges	Tureni	mixed	Nature reserve
Turda Gorges	Mihai Viteazu, Petreștii de Jos	mixed	Nature reserve
Dumbrava Valley	Ciurila	botanic	Nature reserve

Source: Planul de dezvoltare a județului Cluj, 2005, p. 32-33.

Turda Gorges mixed nature reserve and Tureni Gorges mixed nature reserve have been presented above.

Dumbrava Valley is a botanic nature reserve that covers only 0.5 ha on the territory of Ciurila municipality. It shelters a species of lady's-slipper orchid (*Cypripedium calceolus*).

Table 3. Protected areas of county importance in the analysed region

Name of the protected area	Location	Value	Category
Bondureasa Reservoir	Valea Ierii	landscape	Protected area
Borzești Gorges	Iara	landscape	Protected area
Ocolișel Gorges	Iara	landscape	Protected area
Surduc Defile	Iara	mixed	Protected area
Arieș Defile	Iara	mixed	Protected area
Băișoara Mountain	Băișoara	mixed	Protected area
Șoimu Valley	Valea Ierii	cynegetic	Protected area
Iara Valley	Valea Ierii	landscape	Protected area

Source: Planul de dezvoltare a județului Cluj, 2005, p. 31-32.

In the research area there are also 8 natural protected areas of local (county) importance, declared as such throughout the time by the local county government (table 3).

3. CONCLUSIONS

The set of natural factors together with the richness and variety of the human component generated by the existence and development of specific social, historical and economic conditions led to the individualization of a complex and original geographical region, which has a strong impact on multiple plans as it has been shaped throughout the time. This fact is reflected and directly or indirectly materialized in different degrees in the relatively diverse tourism supply and the characteristics of tourism at local and regional scale.

As a result of this situation, one notices a certain concentration and specialization of the categories of tourism objectives on three main components, dominating either the natural ones or the anthropogenic ones, or a combination of the two.

REFERENCES

1. Cocean, P. (1995), *Peșterile României*, Edit. Dacia, Cluj-Napoca.
2. Fărcaș, I., Benţe, D., Trifa, P. (1968). *Indicele climatic-turistic. Aplicaţii la teritoriul Republicii Socialiste România,* Studia Univ. Babeş-Bolyai, 1, Cluj-Napoca.
3. Pop, Gr. P. (2006). *Carpații și Subcarpații României*, Edit. PUC, Cluj-Napoca.
4. Pop, Gr. P. (2012). *DepresiuneaTransilvaniei*, Edit. PUC, Cluj-Napoca.
5. Teodoreanu, Elena (1984). *Bioclimastaţiunilor balneoclimaterice din România*, Edit, Sport-Turism, Bucureşti.
6. *** (2005). *Planul de dezvoltare a județului Cluj, studiu sectorial – turismul*, Proiect nr. 12899/2005, Proiectant: Academia Română - Filiala Cluj, Colectivul de Geografie, beneficiar: Consiliul Judeţean Cluj.
7. *** (2011). *Strategia de Dezvoltare a Județului Cluj pentru perioada 2014-2020*, Document elaborat în cadrul proiectului „Elaborarea Strategiei de Dezvoltare a Judeţului Cluj pentru perioada 2014-2020", Cod SMIS 12836, finanţat din Fondul Social European, prin Programul Operaţional „Dezvoltarea Capacităţii Administrative"*,* beneficiar: Consiliul Judeţean Cluj.

STUDIA UBB GEOGRAPHIA, LXII, 1, 2017 (p. 125-133)
(RECOMMENDED CITATION)
DOI:10.24193/subbgeogr.2017.1.09

WOODEN CHURCHES OF LĂPUȘ LAND – SUSTAINABLE TRAVEL DESTINATIONS

LILIANA MUREȘAN[1]

ABSTRACT. – Wooden Churches of Lăpuș Land – Sustainable Travel Destinations. The church is a holy institution founded for the salvation of people and consists of believers who profess the same faith, being an active organ in continuing the work of salvation in the world, where human life is united with the divine life. The church is joined in meditation, leads to the knowledge of itself in communion with heaven, with something that is not tangible, something that goes beyond human understanding and reason; in church we keep quiet to hear God`s voice in our consciousness. Lăpuș Land is one of the most sustainable tourist destinations which have more than twenty wooden churches, masterpieces of outstanding artistic and technical achievements, elements that are harmoniously integrated in the specific land, evidencing the faith and unity of the Romanian people.

The oldest wooden church in Lăpuș Land is the wooden church in Rogoz (1663), included on the list of World Heritage Sites, followed by four other churches that belong to the seventeenth century: Sfinții Arhangheli in Libotin (1671), Sfânta Parascheva in Rogoz (1695), Adormirea Maicii Domnului in Lăpuș (1697) and Biserica Sfinții Arhangheli in Vima Mică. Eleven churches belong to the eighteenth century: Dobric (1701), Drăghia (1706), Cupșeni (1733), Răzoare (1740), Dobric (1740), Ungureni (1760), Larga (1771), Libotin (1776), Inău (1778), Cupșeni (1778), Boiereni (1782). During the nineteenth century, the faith and unity of the nation is strengthened by the building and conservation of eight churches: Poiana Botizii (1825), Peteritea (1842), Groape (1842), Stoiceni (1860), Costeni (1875), Răzoare (1875), Costeni (1888) and Fântânele (1900). Three elements were and are essential and obligatory for church building: Man, Wood and God. The paper will present the manner in which these places become tourist attractions and what they need to be a sustainable tourist destination.

***Keywords**: sustainable tourist destinations, wooden churches, conservation, tradition, faith.*

[1] *Babeș-Bolyai University, Faculty of Geography, 5-7 Clinicilor Street, Cluj-Napoca, Romania, e-mail: m_casia2010@yahoo.com*

1. INTRODUCTION

Tourism is a sector in a continuos development of national and global importance. Romania has a varied natural potential, to which one adds the valuable cultural and historical heritage, represented by churches, monastic complexes, architecture and art monuments, historical centers and archaeological sites. The sustainable development of tourism is a continuous process and involves the monitoring of the impact that this activity has on environmental factors and aims at maintaining a high level of tourist satisfaction, increasing their awareness about the principles of sustainability and the promotion of the best tourism practices.

The most important principle regarding sustainable development concerns the protection and conservation of the values of the present generations, so that the needs of the future generations be satisfied without compromise. An exceptional heritage is represented by the wooden churches in Romania, which might be considered as sustainable tourism destinations. Useful contributions have been made over time by church and state authorities to preserve and improve the quality of these buildings. Wooden churches in Transylvania are very famous in the world, especially for their purely artistic qualities, proportions, soundness, clarity, details, contrast and also because they fit into the landscape. The wooden churches in Romania usually show a high artistic quality (Steinbrucker, 1932), being the popular soul expression (Petranu, 1934), mirroring the soul of the people (Bloch, 1932), proving a developed artistic taste and a long practice in the wooden art (Henry, 1930).

The Romanian people are essentially traditionalist and conservative. Popular art subsisted until today, preserving both wood and stone architecture (Petranu, 1934). Wooden churches express many of nation`s attributes (Erixon, 1934). Architecture defines the people because there is a Romanian religious art which have its own personality unique in the world (Alazard, 1933). The wooden churches value consists of a distinctive note that manifests as a whole, presenting a number of common features, such as: rectangular planimetry, oblong between sunrise and sunset, nave arching roof of four slopes and workmanship quality (Petrescu, 1974). Technique, form and decoration vary very much from one region to another, depending on the different living conditions of the community. Woodworking requires both artistic sense, dexterity and also skills necessary for the processing. The ornamental style prevails over geometrical style and the wooden objects decoration includes floral, zoomorphic and anthropomorphic motifs. Wood primacy in this sacred architecture is due to both natural potential and also the strong tradition in wooden art. The tradition to build wooden churches has been very important in the countryside until the second half of the nineteenth century, influencing some churches from the 18th, 19th and even 20th century, built by using stronger materials (Retegan, 1995). Over time, wood was the main raw material for Romanian people and it was used in constructions, in the manufacture of tools, objects and furniture products. The craftsmen, showing patience and talent, can give life to wood which identify the Romanians as a nation, by preserving the traditions of our ancestors. In this technique of wooden work, there are many types of wood which are used differently: strong essences such as fir and oak wood are used in constructions, beech is used for the chests of drawers, horn and nuts are used for beat herding, ash frames for doors and windows and maple and lime for distaffs, spoons and boxes.

1.1. The aim and purpose of the study

The main purpose of this study consists in outlining the strategies for the conservation and promotion of wooden churches in Lăpuș Land, for their inclusion in package tours.

To achieve the study purpose, the next steps are performed:

- the identification of the defining elements that provide value to these masterworks;
- the determination of the attractiveness depending on age, degree of conservation and accessibility.

The research results will be supported by maps and photos.

2. RESEARCH METHODS

This study is the result of the activity of documentation and information, the interpretation of bibliographic material from the involved scientific literature and also the result of the fieldwork and the interpretation of data and the information obtained.

The scientific research methods used for the study are: the direct observation method, the indirect observation method, the analysis method, the induction method, the deduction and selective method, the dynamic method, the comparation and the hystorical-geographical method.

3. THE RESULTS AND THE INTERPRETATION. CASE STUDY: THE CHURCHES OF ROGOZ AND LĂPUȘ

Lăpuș Land is considered one of the most important areas especially for wood architecture and artistic achievements, which have left prints of the solid faith and skillful craftsmen of the past.

"Wooden churches were the first cultural centers which have ensured the preservation and circulation of Romanian old qualities" (Bott, 2014).

On the UNESCO World Heritage List, there are eight wooden churches in Maramureș, including "Sfinții Arhangheli Mihail și Gavril" Church in Rogoz village, Lăpuș Land. This church was constructed in 1663, as stated by the inscription at the entrance, after the Tartar invasion from 1661.

Fig. 1. The church in Rogoz (photo: author)

Fig. 2. Church rood screen (photo: author)

Fig. 3. Painting fragment (photo: author)

Fig. 4. "Horse heads" and "the old men table" (photo: author)

Some of the fundamental features of the church are the following:

- Architecture: elm solid wood beams concluded as mails with seven sides, the nave with aisles without the porch;
- A unique element is the end of beams which supports the eaves, having a "horse head" form (125 heads) and in the East a gallop is represented, which symbolize the running toward eternity;
- The door frame has a gothic element in the upper side in the form of accolade;
- The roof was made asymmetrically with a very expanded north side, having the purpose to protect the wood old ancestors called "the old men table". This table is designed for official "alms" in the memory of those people who passed away and consists of two hewn beams and cross sectional notched lines.
- The tower has an element rarely found in the area, an almost conical coif with turrets at the corners.
- Outside, on the southern side, the median wall shows the twisted rope motif which symbolizes the tree of life and the connection between earth and heaven.
- The painting made by Radu Munteanu and Nicolae Man is similar in style with the painting made in the church of Desești, showing bright colors and thick limes.

As opposed to the church in Rogoz, meant for peasants, the church in Lăpuș was built in 1582 for the nobility, being called "Nemeșilor (Noblemen's) Church" (Bott, 2014). It is also registered on the UNESCO World Heritage List and it has the following fundamental features:

- The architecture preserves the traditions of Maramureș wooden churches, so the church was built of wood carved with the axe and has a stone fundation;
- Like the church in Rogoz, the church in Lăpuș also has an "old men table" but in this case the table is situated on the southern side, near the entrance in the church;
- The tower is simple, the turrets are no longer present as in the case of the church in Rogoz.
- A remarkable piece of a great artistic value is the entrance gate from the vestibule in the nave. This door has geometrical motifs such as triangles which simbolize the mastery of the feelings;
- The entrance door is simple, as it is decorated only on hinges;
- In the vestibule, some fragments of the original painting are preserved, including episodes from "The Last Judgment" and "The Passion of Christ";

- The west wall shows a rarely seen scene, named "The wheel world": a wheel with eight spokes. On each spoke there is a number and a phrase which reveals the manner in which people think about when they have a that age (25 years old – the world is delightful, 40 years old – who is like me, 60 years old – oh, world, how wrong I was);
- The painting was made by the same artist as in the church of Rogoz (Radu Munteanu);

Fig. 5. The church in Lăpuș (photo: author)

Fig. 6. The gate entrance to the nave (photo: author)

Arrived in front of this church, one does not know what to admire first: the spirit of meticulousness and patience of the rural craftsmen, the brilliant manner in which they blended certain architectural laws, "the artistic beauty of the entire sanctuary and the lonely parties, clarity of lines, the solid building, groomed design, light changes and shadow, harmony with surrounding fusion power and grace of the entire" (Steinbrucker, 1932).

In Lăpuș Land geographical space, ancient faith and the culture of these people have left clear traces in these churches that last from unbridled human care to earth and country and also for soul and traditions.

In order to highlight the attractiveness of the wooden churches of Lăpuș Land, we took into account: the age, degree of conservation, the distance to polarizing centers and accessibility. Thus, it came out that the churches in Rogoz and Lăpuș have the highest degree of attractiveness, followed by the churches in Libotin, Stoiceni, Boiereni and Cupșeni. In the analysis of the maps, one notices that the oldest churches are in a high state of conservation and they are the most attractive ones, thus emphasizing the sustainable development character of the wooden churches in Lăpuș Land.

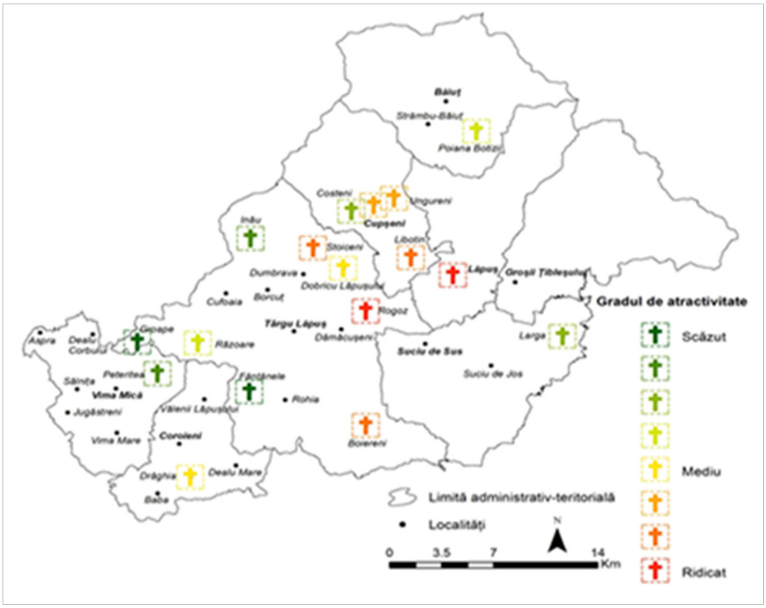


Fig. 7. The attractiveness of the wooden churches in Lăpuș Land
(source: the author)

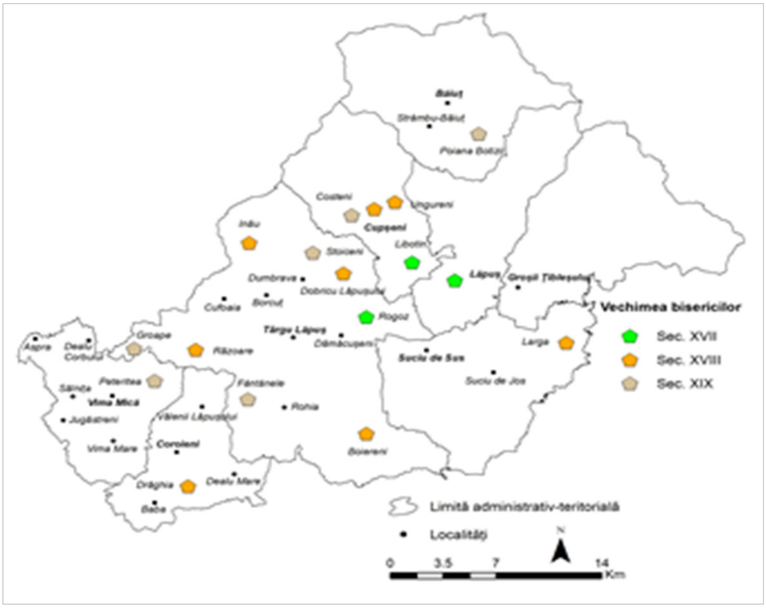


Fig. 8. The age of the wooden churchesin Lăpuș Land
(source: the author)

Strategies of conservation and promotion of wooden churches in the area studied

General strategic objectives:

1. Ecclesiastical heritage conservation;
2. Tourism promotion of wooden churches;
3. Sustainable maintenance of wooden churches;

Programmes, measures, policies:

1.1. The renovation of facades;
1.2. The restoration of the painting according to the specific and authentic painting in the area;
1.3. The inclusion of the churches on the built heritage lists of the area for their protection;
2.1. The creation of promotional flyers;
2.2. The creation of websites for promotion;
2.3. The setting of common tourist information points, represented by panels and information offices;
2.4. The setting of pilgrimage tours and cultural-religious tourism circuits;
3.1. The rational use of funds for the preservation of wooden churches;
3.2. The development of a climate of cooperation between locals, church and local government, whose purpose is to protect the religious buildings concerned;
3.3. The development of access infrastructure.

4. CONCLUSIONS

Table 1. SWOT Analysis of Lăpuş Land

STRENGHTS	WEAKNESSES
➧ High number of wooden churches; ➧ Important objectives in religious, architectural and historical terms; ➧ A high degree of attractiveness based on seniority, conservation and accessibility; ➧ An abundance of ornaments, sculptures and motifs; ➧ Their inclusion on the UNESCO World Heritage List;	➧ Poor infrastructure; ➧ Insufficient/lack of promotion of local tourism (information points, boards, leaflets); ➧ Large distance from the polarizing centers;

OPPORTUNITIES	THREATS
➧ Awareness and involvement of people in the protection of ecclesiastical heritage; ➧ The development of local partnerships; ➧ Installation of information boards and leaflet distribution; ➧ The development of cultural tourism circuits and religious pilgrimage.	➧ Insufficient promotion attracts a small number of tourists. ➧ Lack of education and training systems to support sustainable development.

REFERENCES

1. Bott, Mărioara Rozica (2014). *Vacanță în Țara Lăpușului,* Edit. Galaxia Gutenberg, Târgu Lăpuș.
2. Steinbrucker, Ch. (1932). *Die Denkmalpflege*, Berlin-Vienna and *Die Christliche Kunst*, München, apud Coriolan Petranu (1934), *Bisericile de lemn ale românilor ardeleni*, Sibiu.
3. Giurescu, C. (1976). *Istoria pădurii româneşti din cele mai vechi timpuri până astăzi,* second revised edition, Edit. Ceres, Bucharest.
4. Alazard, J. (1933). *Théodore Chasseriau*, Gazette des beaux-arts, Paris.
5. Bloch, O. (1932). *Die Weltkunst*, Berlin, apud Coriolan Petranu (1934), *Bisericile de lemn ale românilor ardeleni*, Sibiu.
6. Petranu, C. (1934). *Bisericile de lemn ale românilor ardeleni*, Krafft Drotleff, Sibiu.
7. Henry, P. (1930). *Les églises de la Moldavie du Nord*, PhD thesis, Sorbonne, Paris.
8. Retegan, M. (1995). *Arta prelucrării lemnului*, Baia Mare.
9. Rus, D., Bott, Mărioara Rozica (2000). *Țara Lăpușului*, Edit. Corvin, Deva.
10. Stoica, Georgeta, Pop, M. (1984). *Zona etnografică Lăpuș.* Edit. Sport-Turism, Bucharest.
11. *http://primariatargulapus.ro/, accessed on September 2, 2016.*

STUDIA UBB GEOGRAPHIA, LXII, 1, 2017 (p. 135-143)
(RECOMMENDED CITATION)
DOI:10.24193/subbgeogr.2017.1.10

THE PROFILE OF A PERFECT TEACHER: VULPE T. BUJOR-COSTICĂ (1924-1983)

AL. PĂCURAR[1]

ABSTRACT. – The Profile of a Perfect Teacher: Vulpe T. Bujor-Costică (1924-1983). Vulpe T. Bujor-Costică was for a short time a member of Institute of Geography belonging to Cluj University. In the second year as a student, he was asked by the head of the institute, professor Sabin Opreanu, to become a drawer at the Institute and he had this job between April and September 1947. Originating from an ancient Romanian family in Orăștie, Vulpe T. Bujor-Costică has been educated at the pre-communist Cluj Geographical School, whose bases were laid by the scientist George Vâlsan. He graduated in 1953 with a major in Geography, within the Faculty of Sciences of Cluj University. Between 1957 and 1983 he was a teacher at the Cluj School for Blind and Visually Impaired and an author of school books in Braille alphabet. At the same time, he activated in the "Iacob Mureșianu" male choir of the Cluj Culture Centre.

Keywords: *drawer, Institute of Geography, teacher, Geography school books, Braille alphabet.*

Out of the bright gallery of the members of the Institute of Geography belonging to Cluj "King Ferdinand I" University, which existed between 1919 and 1947, the figure of Vulpe T. Bujor-Costică was a meteoric sight, from spring to autumn 1947. During this period, as a Geography student in the second year at the Faculty of Sciences of the university, he was given the job at the Institute of Geography by professor Sabin Opreanu, who was head of the Institute of Geography in the most difficult period of its existence (September 1, 1941, to September 1, 1947), until he was fired with the arrival of the communists. In line with the good traditions of the institute, professor Opreanu hired in spring 1947 the hard-working 2nd year student for the position of drawer.

[1] *Babeş-Bolyai University, Faculty of Geography, 5-7 Clinicilor Street, Cluj-Napoca, Romania, e-mail: alexandru.pacurar@ubbcluj.ro.*

The political and social context of this period was very gloomy, as Romania was occupied by the Red Army. Under its protection, the Soviets and their Romanian fellows began a diabolical process to turn the country into a communist one. During this, the leaders of the historical political parties were annihilated, the best officers were removed from the Romanian Army, the economy suffered a continuous erosion as the trade unions became involved politically, the smartest scientists, teachers and highbrows were set aside from education and the cultural environment.

The student Vulpe T. Bujor-Costică in the 1945/1946 academic year

In this difficult atmosphere, in the summer of 1945, the university with all its institutions returned from its refuge to Cluj. However, the social and political climate was agitated because of the Soviet military occupation which began to demolish the country by setting the communist into power, a process which peaked with the abusive and antidemocratic change of the constitutional order by forcing the abdication of King Michael I on 30 December 1947. Then, a group sold to Moscow and under the Soviet protection has conducted the proclamation in Parliament of the Romanian People's Republic. The development of the events is described in the well-documented book of Eliodor Focșeneanu (1997), *Două săptămâni dramatice din istoria României (17-30 decembrie 1947)*, which translates as *Two dramatic weeks in the history of Romania (17-30 December 1947)*, All Publishing House, Bucharest. For half a century, this established the communist dictatorship in Romania, the so-called leadership of the working class, in reality led by less than mediocre people, supporting atheism and Comintern internationalism, concepts foreign to the vast majority of Romanians. Who were these "revolutionists"? The last democratically elected prime minister of Romania, general Nicolae Rădescu, described what the negotiations to form the government looked like (Demetriade, Șerbănescu, 2015, pp. 121-122): "*Because the first attempt to form the government* [the negotiations, s.n.] *was interrupted in the last minute due to the hostility of Ana Pauker, agent of the Russians* […], *I started a consultation of all the groups* […]. *I contacted Pătrășcanu, who was apparently the leader of the Communist Party* […]. *Although not only the communists, but also the members of the F.N.D.* [National Democratic Front] *were all present, only two people participated in the discussions... Luca* [Vasile, in reality László, s.n.] *and Ana Pauker* [in reality Hanna Robinsohn, s.n.]. *They were both coarse and provocative, at the same time, they were lacking* *the formation and education for the assumed role of leaders. From the very beginning I realized I will meet their hostility. In fact, from the first moment the atmosphere became hostile because, when talking about Bessarabia, both of them very promptly asserted that this province has never been Romanian and therefore Romania had no right for it*". So this is the profile of the country destroyers. In a normal state, all the decisions taken from institutions led by such people would have been declared void!

In this very bleak context, in the summer of 1945, "King Ferdinand I" University returned gradually to Cluj from its refuge at Sibiu and Timişoara, until the autumn of the same year, when the 1945-1946 academic year started. The moment of return from its refuge is described by Mrs. Dumbravă Hora-Crăiţa (September 2016), daughter of the teaching assistant Fabiu I. Dumbravă from the Institute of Geography, then a young girl who was 10-11 year old: "*I came back from the refuge in Timişoara with my parents in the summer of 1945. For my parents, as well as for other teachers and their families, the university made available a train coach where we put all our furniture and belongings. Once we arrived at Cluj railway station, after an exhausting voyage, our belongings were loaded in a military truck and transported to the University, where they were downloaded and stored in the basement of the building. We also stayed there for about two weeks, together with other university staff families, until we were provided accommodation in the city. The inner court, the corridors of the university and also the street of the university vibrated because of our voices and our childhood games, as we were happy to return home*". With the new "leaders" of the country fraudulently set by the Soviet commanders, "King Ferdinand I" University entered a new stage of its existence. In the beginning, some skilled teachers were "*compressed*", meaning that they were removed, as they had been clerks of the former political regime. Many of them were highbrows, like the secretary general of the university, Ioan A. Vătăşescu, rejected by the "trade union members". In 1945, faithful citizens of the country where they lived, some Hungarian nationals gained profit of the Soviet occupation and established in Cluj a Hungarian university named "Bolyai János". In 1948, "King Ferdinand I" University was renamed at once… "Victor Babeş". Later, in 1959, the two universities problematically merged becoming "Babeş-Bolyai" University.

In the context of the year 1947, professor Sabin Opreanu selected Vulpe T. Bujor-Costică, then a Geography student in the second year, as a member of the Institute of Geography which he headed, providing him the position of drawer. Of course, the professor have seen the student as a hopeful element, as he originated from a great family of Romanian patriots, who contributed to the enforcement of the national sentiment in Transylvania, which became manifest across the entire united country after the First World War.

The family and formation of the teacher Vulpe T. Bujor-Costică are defining elements of his profile and personality. He was born on 30 September 1924, at Orăștie, the youngest son of Vulpe Teodor and Vulpe Alexandrina. Vulpe Teodor originated from Felnac, Arad County, and he became a "*landlord and forest trader in Orăștie*" founding member of the Romanian Forestry company in Cluj (the newspaper "*Românul*" [the Romanian], Arad, no. 187, 20 December 1919, p. 4, accessed on documente.bcucluj.ro/web/bibdigit/periodice/), then general manager of Dacia Bank in Orăştie. Alexandrina Vulpe originated from Strei, near Călan, Hunedoara County, and was a "*raving beauty*" in her youth. The couple had four children, three boys: Iulian Romulus, Tudor Lucian and Bujor-Costică, and one daughter, Stella Sofia. Vulpe Teodor was a graduate of the Faculty of Theology in Arad and became a prosperous businessman in Orăştie due to his own merits, a forest trader and owner of a furniture shop. In the memory of the family, he is remembered as "*handsome, distinguished and elegant*".

The parents Vulpe Teodor (1883-1931) and Vulpe Alexandrina (1880-1946)

Due to his enterprising nature, he was named head of Deva Chamber of Commerce. Politically, he was a member of the Liberal Party and in this quality he became mayor of Orăştie between May 1929 and 31 July 1931, when he died prematurely. His demise was caused by the grief induced by the death of his daughter, Stella Sofia. She was 18 years old and attended the courses of a boarding school in Vienna when she contacted a galloping pneumonia that caused her death; her father died within a month. Vulpe Alexandrina lived for another 15 years and died in 1946, when Vulpe T. Bujor-Costică was student in the first year in Cluj.

Vulpe T. Bujor-Costică attended and graduated in 1945 the high school courses at "Aurel Vlaicu" High School in Orăştie, an elite Romanian high school, established in 1919. There, he acquired knowledge, skills, a proactive attitude towards work, a high civic and patriotic spirit, under the guidance of exceptional teachers. Many of his teachers could have been successfully included in university departments, as was the case of his Geography teacher, Ioachim Rodeanu, former assistant at the Institute of Geography at Cluj University between 1920 and 1923, who opted however for a teaching position at the high school in Orăştie, closer to his native village.

The graduates of "Aurel Vlaicu" High School in Orăștie, class of 1945, and their teachers (young Vulpe is the sixth – the last – in the fourth row, to the right)

Strongly influenced by the personality of his high school Geography teacher, whose lessons in class were completed by field trips and holiday camps throughout the entire country, in this true civic and patriotic school called "*Străjeria*" (the Boy Scouts), the young bachelor opted for the Geography university courses which he attended at the Geography section of the Faculty of Sciences within "King Ferdinand I" University of Cluj. In the second year of studies (1946-1947), in the spring of 1947, he was hired as a drawer at the Institute of Geography of the university by the head of the Institute, professor Sabin Opreanu. He had this position only for a few months because in September 1947 he was no longer mentioned among the employees of the Institute, as he was dismissed from all the functions; in fact, the head of the institute was also removed. The new regime did not need young people coming from solid Romanian families, belonging to the bourgeoisie. It is all the same a miracle that in 1953, during the worst period of communism (1948-1962), he succeeded to complete his studies at the Faculty of Geology-Geography at "Victor Babeş" University of Cluj, becoming a graduate after several interruptions caused by diverse reasons. One of the reasons was however a happy event, the marriage to Suciu Lucreţia on the 3rd of May 1948. The couple had a happy marriage, blessed by the birth of a daughter, Vulpe Alexandrina Lucreţia, on the 18th of April 1952. She is now a distinguished teacher of French Language and Literature in Cluj, receiving the first (highest) level of teacher certification in 2004.

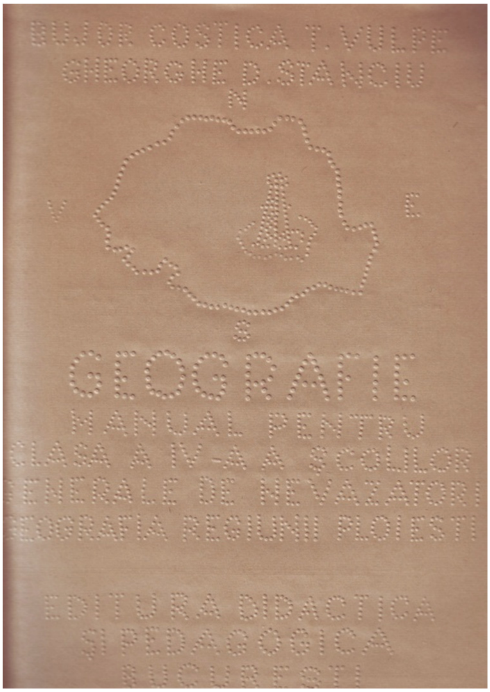
The professional activity of Vulpe T. Bujor-Costică is rich, vast and diversified. While a student, he was involved in different activities. Apart from the position of drawer at the Institute of Geography (1947), he was employed in the office of the Romanian Railways Company (CFR) between 1948 and 1949 and then as a teacher at the CFR Vocational School in Cluj. After the graduation, he was a Geography teacher at the CFR Vocational School and then at the Food Industry Technical School (1953-1955), a mixed general seven-year school (1955-1957) and the Special School for the Blind and Deaf (1957-1959). In this difficult part of the communist period, he was a school inspector for a short period of time (1951). The activities performed in these positions allowed him to cover his "unhealthy" bourgeois origins. He finally succeeded to become a tenure Geography teacher at the Special School for Blind and Visually Impaired in Cluj in 1959, where he worked until his premature death in 1983, aged only 59.

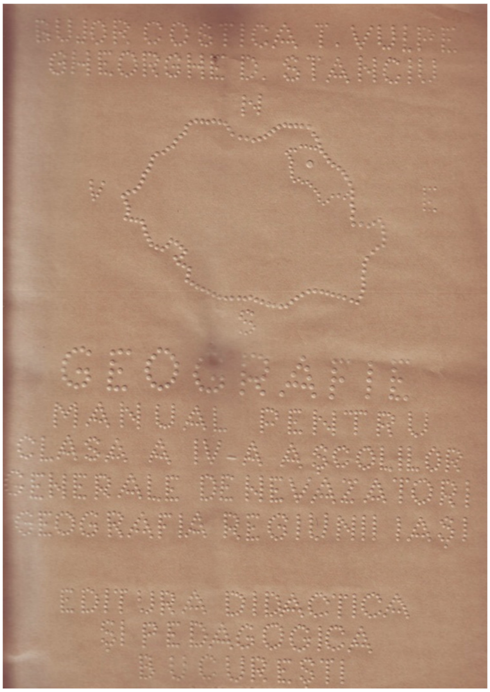
Le professeur Vulpe T. Bujor-Costică (1924-1983) avec son épouse et leur fille, en 1971

Dedicated to his work as a teacher, as he learned from his teachers in high school and university, motivated by the passion to "enlighten" the blind, professor Vulpe T. Bujor Costică authored, together with Gheorghe Stanciu, the first Romanian Geography school books in Braille, a writing system designed for the visually impaired, in which the letters are represented by raised dots, which are identified by touching them with the fingers. Having in mind the visually impaired, the two teachers authored Geography school books for the 4th form, "*The Geography of Iași Region*" and "*The Geography of Ploiești Region*". As far as we know, Vulpe T. Bujor-Costică is the only member of the Institute of Geography of Cluj University who has written Geography school books in Braille for the visually impaired. In 1969 he received the first (highest) level of teacher certification. The brave professor had also a remarkable cultural activity as a member of "Iacob Mureșianu" male choir at Cluj City Culture Centre, under the direction of Marius Cuteanu. The choir was established in 1970 and the honorary president was Ştefan Pascu, member of the Romanian Academy. The first director was professor Romeo Ghircoiaşu from "Gheorghe Dima" Musical Conservatory of Cluj.

Animated by the desire to enlighten by teaching to his pupils, convinced that "*nothing is more beautiful and noble than being a teacher*" (Dumitru Almaş), professor Vulpe T. Bujor-Costică educated and formed many generations of students. He also injected the passion for teaching and for the profession of teacher to his daughter, Alexandrina Lucreția. A valued teacher in Cluj, she confessed: "*Ever since I was a child, the pedagogical atmosphere created by my father guided my steps towards a teaching career. I am a graduate of the Faculty of Letters in 1977 and a teacher of French, a subject of study suggested by my father who helped me a lot with the lessons because he also had a deep knowledge of this language*". In this way, the passion for teaching was passed over to his daughter who tried to reach the level of her father. In December 2002, as a teacher at "Mihai Eminescu" High School of Cluj, she published an auxiliary school book for the usage of pupils and teachers - "*Une autre façon d'enseigner la phonétique*" ("*Another manner to teach Phonetics*"), accompanied by an audio cassette. She guided the pedagogical practice of the students of French at the Faculty of Letters.

A year later, she published another auxiliary school book - "*Une autre façon d'enseigner les themes*" ("*Another manner to teach the subjects*"). In 2003 she guided once again the students of French pedagogical practice in the high school and, as she asserted "*it is not a mere coincidence that these students come from the Geography and French specialization, which proves that nothing is really random*". This is, certainly, the manner in which the daughter cherished once again the memory of her father, the Geography teacher Vulpe T. Bujor-Costică, as she followed his example! She provided the photos inserted in the text. Important pieces of information have been given by his cousin, the honorable Mr. Vulpe Teodor Marius, who lives in the house of his grandparents in the centre of Orăştie and who is the most competent depositary of their grandparents' memory. Other pieces of information were provided by their cousin, Mrs. Cîrje Stella Ileana, a former teacher in Cluj, now retired. I thank all of them for their cooperation!





The covers of the Geography school books for the 4th primary form, in Braille, whose first author is Vulpe T. Bujor-Costică

The short presentation of the life and activity of Vulpe T. Bujor-Costică, teacher and former member of the Institute of Geography belonging to "King Ferdinand I" University of Cluj, a true school for the professional and civic formation of young researchers, is enrolled in the efforts to convey to posterity the bright figures of this institute, whose foundations were laid by the determination and passion of professor George Vâlsan. Compared to the derisive disciples of today, their life and activities, dedicated to the development of the community and of the homeland, are examples that deserve to be followed!

REFERENCES

1. Demetriade, O. I., Şerbănescu, Al. (2015). *Generalul Nicolae Rădescu. Profilul unui om de stat în imagini și documente*, Edit. Oscar Print, București.
2. Focşeneanu, E. (1997). *Două săptămâni dramatice din istoria României (17-30 decembrie 1947)*, Edit. All, București.
3. "*Românul*" (newspaper) (1919). No. 187, 20 December 1919, p. 4, Arad, accessed on: *documente.bcucluj.ro/web/bibdigit/periodice/*